

Site Management Plan

Former Nansemond Ordnance Depot

Fiscal Year 2006



**US Army Corps
of Engineers** ®
Norfolk District



Issued December 2005

Site:

The Former Nansemond Ordnance Depot
Suffolk, Virginia
C03VA004500, Formerly Used Defense Site

Prepared By:

United States Army Corps of Engineers
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Former Nansmond Ordnance Depot
Fiscal Year 2005

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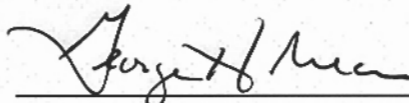
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1 Introduction

This report presents the Site Management Plan (SMP) for the United States Army Corps of Engineers (USACE) Norfolk District activities at the Former Nansemond Ordnance Depot (FNOD) in Suffolk, Virginia. FNOD qualifies as a Formerly Used Defense Site (FUDS) pursuant to the Environmental Restoration Defense Account and the Defense Environmental Restoration Program (DERP), Chapter 160 of the Superfund Amendment and Reauthorization Act of 1986. The USACE is responsible for environmental investigations and remediation of FUDS. The Norfolk District is responsible for oversight of FUDS activities at FNOD, with assistance from the Baltimore and Huntsville Districts.

On 22 July 1999, the U.S. Environmental Protection Agency (EPA) placed FNOD on the National Priority List (NPL). EPA listed FNOD as a Non-Federal Facility Superfund Site, as the Federal Government does not currently control any property at FNOD. However, the EPA named the Department of Defense as a Potential Responsible Party for addressing environmental issues at FNOD (64 Federal Register No. 140, 39878; July 22, 1999).

Federal Agencies remediating NPL (a.k.a. Superfund) sites commonly enter into Inter-Agency Agreements (IAGs) that cover roles and responsibilities during the clean up. The final IAG at FNOD is still in negotiation. In this SMP, all references to an IAG will be to the draft IAG dated 2 June 1999, which primarily contains IAG model language developed by EPA and the Department of Defense (DOD).

All site work completed under this SMP will also be in compliance with State and Federal Historic Preservation regulations. To ensure compliance with Section 106 of the National Historic Preservation Act, a Programmatic Agreement was signed by the Norfolk District, EPA Region III, the Virginia State Historic Preservation Officer (SHPO) and other interested parties.

The Archaeological Work Plan (AWP) appended to the Programmatic Agreement (PA) details how the agreement will be implemented. The AWP was developed and approved by Norfolk District, EPA Region III and the SHPO. The plan calls for the Archaeologist to review work plans, contracts, scopes of work and other planning documents in order to identify possible adverse effects to significant historic properties as a result of site activities. The plan includes a map of areas having high, medium and low probability of archaeological resources. The AWP also provides for review of ground-disturbing activities that occurred prior to implementation of the PA, monitoring of upcoming ground-disturbing actions in high probability areas and procedures to be followed in the event of an unexpected discovery of archaeological resources. (*Programmatic Agreement*, ARF 01-13-037 and *Archeological Work Plan*, ARF 02-01-025)

2 Purpose

The purpose of this SMP is to disseminate environmental clean-up information in accordance with the requirements of the IAG and includes the following:

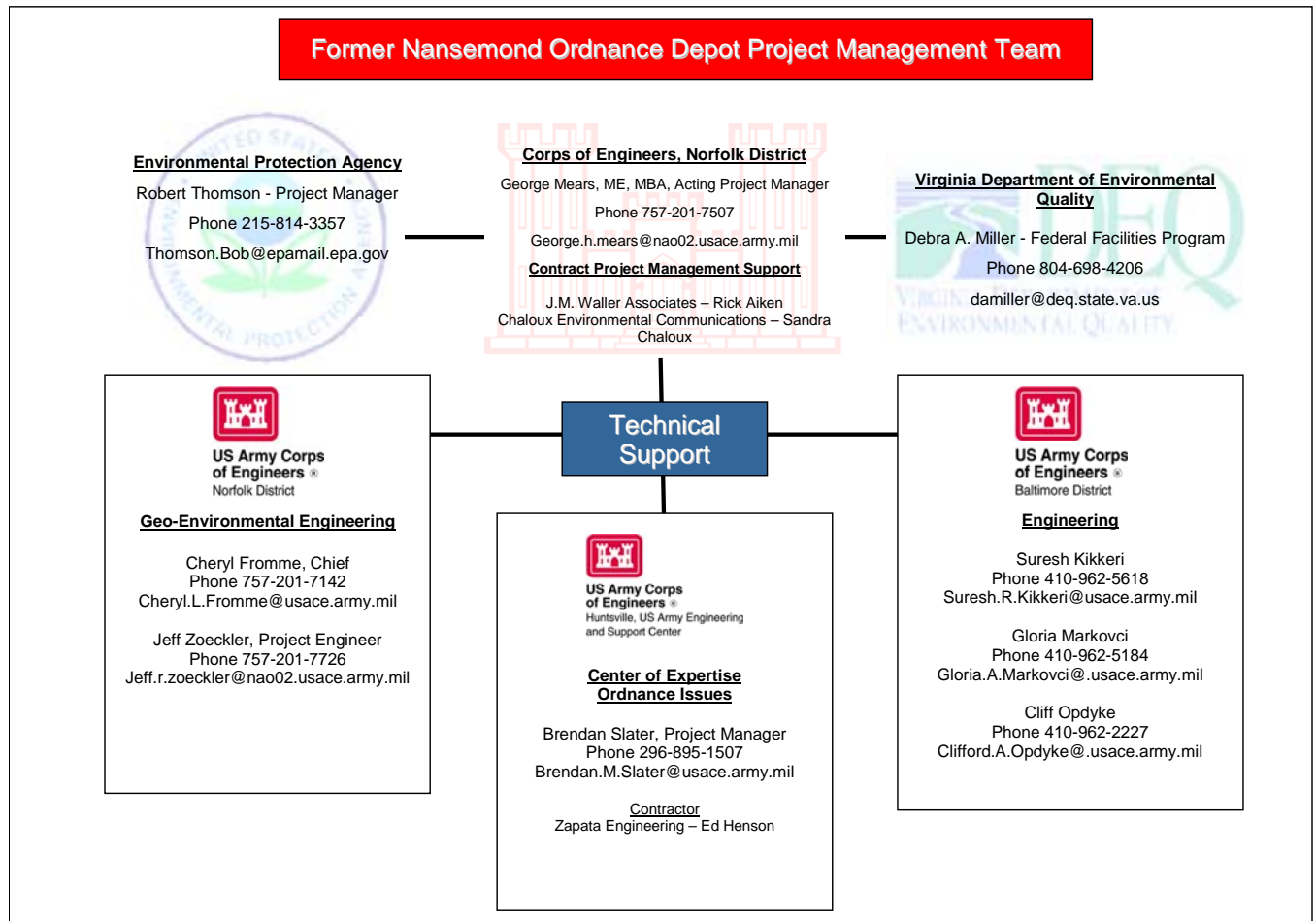
- A list of Source Areas, Areas of Concern, Areas of Interest, Operable Units, etc...
- Proposed environmental clean-up activities at each area and schedules including deadlines, near- and long-term milestones, significant target dates, and project end dates.
- Primary document submittal dates for the current fiscal year and subsequent two years.

Due to the nature of past activities conducted at FNOD, it is divided into several smaller sites, categorized as either a Source Area (SA) or Area of Concern (AOC). This SMP summarizes investigations and activities to date for each area and provides work plans and schedules for Fiscal Year (FY) 2006. Additionally, FNOD SMP compiles and references germane site documents which are located in the FNOD Administrative Record File (ARF) located at the USACE Norfolk District office. The ARF contains documents forming the basis for the selection of response actions at FNOD. The ARF may be searched using the document catalogue available on the Internet (<http://www.nao.usace.army.mil/Projects/Nansemond/NumberingRules.htm>).

Public Involvement

The Norfolk District established a Restoration Advisory Board (RAB) in accordance with FUDS guidance. The RAB meets bi-monthly and provides an avenue for public involvement and input. Citizens are encouraged to attend RAB meetings and may review site documents, which are located in the Information Repository at the Tidewater Community College Portsmouth Campus Library. The Norfolk District also conducts Public Affairs Workgroup meetings as needed. Members of the workgroup include the Norfolk District Public Affairs Officer, EPA Region III, Virginia Department of Environmental Quality (VDEQ), the City of Suffolk and current property owners electing to participate.

3 Organizationization



FNOD RESTORATION ADVISORY BOARD			
Sandra Chaloux	CEC, Inc. - RAB Facilitator	Marian "Bea" Rogers	Community Co-Chair
Tim Fink	Tidewater Community College	Dave Saunders	Bennett's Creek Community
Adriane James	USACE Norfolk District - Co-Chair	Carl Serrette	Burbage Grant Community
Bruce Johnson	Respass Beach Community	Rob Thomson	USEPA Region III
Kevin Mattonen	Bennett's Creek Community	Ed Wallingford	Virginia Department of Environmental Quality
Don McDaniel	General Electric	Cherie Walton	Reactives Management Corporation
Debbie Miller	Virginia Department of Environmental Quality	David Wigle	USACE Norfolk District Project Manager
Thomas O'Grady	Suffolk Economic Development Office	Bob Williams	Dominon Power

4 History



FNOD is located in Suffolk, Virginia and consists of approximately 975 acres. It is bordered by the Nansemond River to the west, the James River to the north and Streeter Creek to the east.

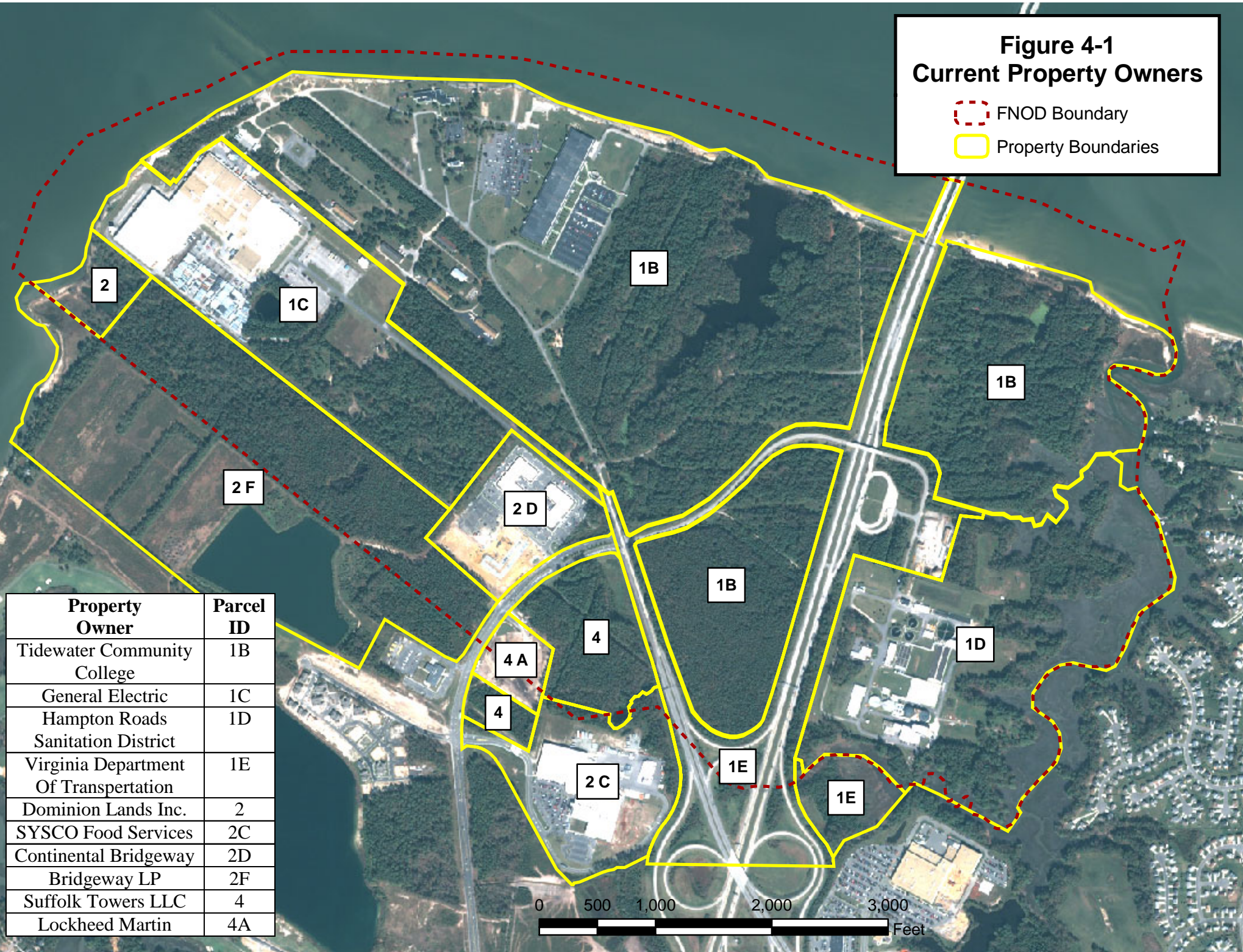
FNOD was constructed, beginning in 1917, to support the Port of Embarkation at Newport News, Virginia and was originally known as Pig Point Ordnance Depot. By 1918, the original depot included 28 Standard Ammunition Magazines, 25 High Explosive Magazines, 13 Smokeless Powder Magazines, 8 Primer and Fuse Magazines, 1 large warehouse, 16 barracks, 2 Officer's Quarters, a hospital, a garage, a fire house, a machine shop, an electric storage battery charging station and support buildings. Other structures included a pier, jetties, guard towers, mess halls, carpenter shops, a water tower, a renovation and salvage plant, railroad tracks and roads. The depot functioned as a storage and distribution center and performed reconditioning of munitions. Captured enemy munitions were also processed at this location. Between World Wars I and II the depot remained active, and in 1929 the facility name was officially changed to Nansemond Ordnance Depot. During World War II, the reconditioning, storage and distribution of ammunition continued.

In 1950, the facility was transferred to the Department of the Navy and named the Marine Corps Supply Forwarding Annex. Information concerning operations at FNOD between 1950 and 1960 is not available. In 1960, the site was declared excess and acquired by the Beazley Foundation Boys Academy. The Virginia Department of Highways received a right-of-way easement over a portion of the property, and 207 acres was sold to the Virginia Electric Power Company, now Dominion Lands. In 1965, 104 acres were conveyed to the General Electric Company (GE), and Nansemond County acquired a 4.7-acre right-of-way easement for a road in 1966. In 1968, the Academy closed and donated the property to the Virginia Department of Community Colleges. The Tidewater Community College (TCC) Portsmouth Campus currently occupies the site, less an 80-acre parcel conveyed to Hampton Roads Sanitation District (HRSD) in 1977. FNOD came to the attention of the Norfolk District in 1987, when evidence of ordnance and explosive waste was discovered and has been under investigation since that time. (*Archives Search Report*, ARF 01-13-006 F)

The current property owners are TCC, Dominion Lands, Continental Bridgeway, Suffolk Towers LLC, Bridgeway LB, GE, Virginia Department of Transportation (VDOT), HRSD, Lockheed Martin, and SYSCO Foods.

**Figure 4-1
Current Property Owners**

-  FNOD Boundary
 Property Boundaries



Property Owner	Parcel ID
Tidewater Community College	1B
General Electric	1C
Hampton Roads Sanitation District	1D
Virginia Department Of Transportation	1E
Dominion Lands Inc.	2
SYSCO Food Services	2C
Continental Bridgeway LP	2D
Bridgeway LP	2F
Suffolk Towers LLC	4
Lockheed Martin	4A

5 Summary of NPL Status

EPA Region III issued the Final Hazard Ranking System (HRS) Package in January of 1999. This package was a culmination of multiple site investigations and resulted in the identification of seven waste Source Areas (SAs). The SAs were evaluated and hazard exposure pathways were assigned numerical values. The final HRS site score for FNOD was 70.01, and a score of 28.5 or higher qualifies a site for placement on the NPL.

The primary event prompting the EPA investigation of FNOD was the 1987 discovery of “bulk explosives, small arms munitions, and other ordnance items, both spent and unexploded” and a several ton slab of crystalline 2,4,6-Trinitrotoluene (TNT) in the 2 to 3 acre site known as the TNT Area. A Remedial Investigation resulted in removal of Munitions and Explosives of Concern (MEC) and contaminated soil from the site. Soil sampling identified several Chemicals of Concern (CoCs) including Metals and Explosives.

The SAs identified in the Final HRS Report included:

- 1 Removal Area – Residual Contaminated Soil (TNT Area)
 - 2 Beachfront Disposal Area (James River Beachfront)
 - 3 Impregnation Kit Area
 - 4 Horseshoe Pond Disposal Area
 - 5A Steamout Pond
 - 5B Park Drive Disposal Area/Burning Ground (Main Burning Ground)
 - 6 Track K Dump
- (Final Hazard Ranking System Package, ARF 01-13-031)

6 Screening Methodology: Technical Approach

The Source Areas described in the HRS Package are investigated following the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) regulations and guidance. In addition to SAs, there are several areas of concern (AOCs), where past activities may have contaminated adjacent media (e.g., soil, sediment, surface water, groundwater). AOCs are identified by examining historical evidence, including aerial photographs, and evaluated using the Site Screening Process for FNOD. The Project Team, by consensus, determines if a specific area warrants listing as an AOC in the SMP.

Once an AOC is identified, the Site Screening Process (SSP) begins with a Preliminary Assessment (PA) and site visit (*Site Screening Process*, ARF 01-13-080 F). The Preliminary Assessment is a review of existing information in order to evaluate and document past FNOD activities, which may have resulted in the release of hazardous substances at the AOC. Preliminary Assessments at FNOD have also been historically referred to as Desktop Audit (DAs). In the future, the Preliminary Assessment term will be utilized in order to be consistent with CERCLA language.

The site visit is a visual inspection of the AOC designed to aid in site characterization; evaluate current site conditions; determine possible contaminant sources, chemical migration pathways; potential human and ecological receptors; and identify potential sampling locations and media. Screening level sampling of surface soil, subsurface soil, surface water, groundwater, sediment or suspicious media may also occur in conjunction with the site visit. Results of the PA, site visit and any screening level sampling are documented in the PA Report. Also included in the PA Report is an AOC-specific description of the possible contaminant sources, exposure pathways and receptors.

If the results of the PA Report indicate that no further action is required at the AOC, it may be removed from further consideration as an AOC upon agreement by the Project Delivery Team. Any agreement to remove an AOC from further consideration must be documented in the ARF and the SMP.

If the PA Report indicates that an AOC requires further study, a Site Investigation (SI) will be performed. The SI may be conducted in order to determine the presence or absence of contaminants, provide data for human health and ecological Risk Assessments, and further delineate the extent of contamination. The first step in the SI is the development of an AOC-specific Work Plan, including a Sampling and Analysis Plan (SAP).¹ The SAP details the number, type and location of samples to be collected.

The Master Quality Assurance Project Plan for FNOD (MQAPP) and SSP list analyses that may be performed during the SI. Environmental media will be sampled and analyzed for the most appropriate chemical compounds, based on the site-specific information available for the AOC. The chemical analyses and analytical methods will be selected by the Project Engineer in

conjunction with the Project Manager and the PDT. In general, samples are typically analyzed for Target Compound List (TCL) volatile and semivolatile organic compounds, pesticides, Target Analyte List (TAL) Metals, including cyanide and mercury. Other analyses that may be appropriate best on AOC-specific information, include but are not limited to total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), dioxins and furans (PCDDs and PCDFs), explosives, and chemical warfare material and degradates. Field work and sample collection proceeds after all appropriate regulatory agencies and Project Delivery Team (PDT) members approve the Work Plan and SAP.

The analytical results are independently validated and may be used in human health and ecological risk screening in accordance with the Site Screening Process for FNOD. Validated analytical results and GPS coordinates of sampling locations are added to the existing FNOD database and used to aid in data analysis, reporting and visualization in ArcGIS and the groundwater modeling software. (*Environmental Data Management Plan*, ARF 02-04-003)

Based on the results of the SSP, the AOC may be recommended for No Further Action (NOFA). If the AOC requires further action, one of the following options will be selected:

- Interim Removal Action and confirmation sampling to demonstrate that risks are reduced to acceptable levels
- Focused Site Investigation, including additional sampling
- Remedial Investigation/Feasibility Study

If the EPA determines that an AOC is a Source Area, and the AOC is added to the NPL, then site investigation and remediation must follow the requirements of CERCLA.

7 Summary of Source Areas and Areas of Concern

This section summarizes past, present and future activities at each site. Prior to 2001, the Site Management Plan identified sites within FNOD as Source Areas, Removal Action Areas or Areas of Concern. The FY 2002 SMP, and subsequent versions, identifies sites as either Source Areas (S-XX) or AOCs (A-XX) and as Operable Units (OU-XX) or Possible Operable Units (POU-XX). The following sections identify the location and size of each site and summarizes the site history (including the information which prompted the site's identification as an AOC or SA), past and present activities, and the current fiscal year plan.

Tasks required for each phase of site work will be approved by Project Delivery Team members. Briefly, investigation of SAs will continue following the CERCLA process as outlined in Figure 7.1 and the Clean-Up Master Flow Chart for FNOD (Figure 7.2). The Clean-Up Master Flow Chart indicates the status of each site – completed work, ongoing activities and projected tasks. This chart assumes a conservative scenario in which at least one AOC in each group requires a Record of Decision (ROD) and de-listing in accordance with CERCLA. This chart is revised each year as investigations proceed. Table 7-1 The OU Planner, provides the groupings of SAs and AOCs with the FUDSMIS (Formerly Used Defense Site Management Information System) project number and Cost to Complete (CTC) programming requirements codes. SA and AOC groupings can be changed based on the current understanding of present risk and changes in major stakeholder requirements.

To determine if an AOC must undergo the CERCLA process, it will be screened in accordance with the SSP (*Site Screening Process*, ARF 01-13-080 F).

Following Section 7 is a section on other relevant investigations and activities. The Project Delivery Team may propose that a site be elevated to an AOC should additional information indicate the need to conduct further investigation.

Table 7-1 FNOD Operable Unit (OU) Planner

FNOD SITE	Source Area / AOC	FUDSMIS Project Number	FUDSMIS Project Name
Ordinance & Explosives		2	975 acre OE
OE Land Use Controls		2	975 acre OE
TNT Disposal Area	1	1	OU-5 TNT Area
James River Beachfront	2	9	OU-1 JRB Area
TCE Contamination	AOC 19	9	OU-1 JRB Area
Impregnite Kit Area	3	4	OU-7IKA
Horseshoe Pond	4	5	OU-3 HSP
GE Burning Ground	5	6	OU-2 MBG
Track K Dump	6	10	OU-4 TKD
Pesticide Drum Area		10	OU-4 TKD
Nansemond River BF	AOC 1	15	POU-8 NRB
Abandoned Structures	AOC 13	15	POU-8 NRB
Arsenic Investigation (GE)	AOC 22	15	POU-8 NRB
Renovation Plant	AOC 23	15	POU-8 NRB
Hydrologic CSM		3	975 Acre HTW
Off Shore Area (far)	AOC 3a	11	OU-6 Off Shore, GP A AOCs
Off Shore Area (near)	AOC 3b	11	OU-6 Off Shore, GP A AOCs
Area J Lake	AOC 7	11	OU-6 Off Shore, GP A AOCs
TCC Lake	AOC 5	11	OU-6 Off Shore, GP A AOCs
GE Pond / Nansemond Culvert	AOC 4	11	OU-6 Off Shore, GP A AOCs
Track G Line Scars	AOC 10	12	POU-9 GP B AOCs
Track Hand I Line Scars	AOC 11	12	POU-9 GP B AOCs
Abandoned Water TP	AOC 20	12	POU-9 GP B AOCs
Marine Cops Pwr Gen	AOC 6	12	POU-9 GP B AOCs
Track J Line Scars	AOC 12	12	POU-9 GP B AOCs
Track K Line Scars	AOC 14	13	POU-10 GP C AOCs
Track K Land Fill	AOC 15	13	POU-10 GP C AOCs
Suspected USTs	AOC 18	13	POU-10 GP C AOCs
Removed Steam Plant	AOC 16	13	POU-10 GP C AOCs
PCB Transformers	AOC 17	14	POU-11 GP D AOCs
Track A and B Burn Gnd	AOC 9	14	POU-11 GP D AOCs
Track A Disposal Pit	AOC 8	14	POU-11 GP D AOCs
Streeter Creek	AOC 2	14	POU-11 GP D AOCs
Sites At or Near Resloution			
Impregnite Kit Area	3	Delisted	
O'Club Pool	AOC 21	NOFA by Consensus letter - done	
TCE Contamination	AOC 19	NOFA included in NRB RI - working	
GE Pond / Nansemond Culvert	AOC 4	NOFA by SSP Report - working	
Abandoned Water TP	AOC 20	NOFA by Consensus letter - done	
Suspected USTs	AOC 18	NOFA by Consensus letter - done	

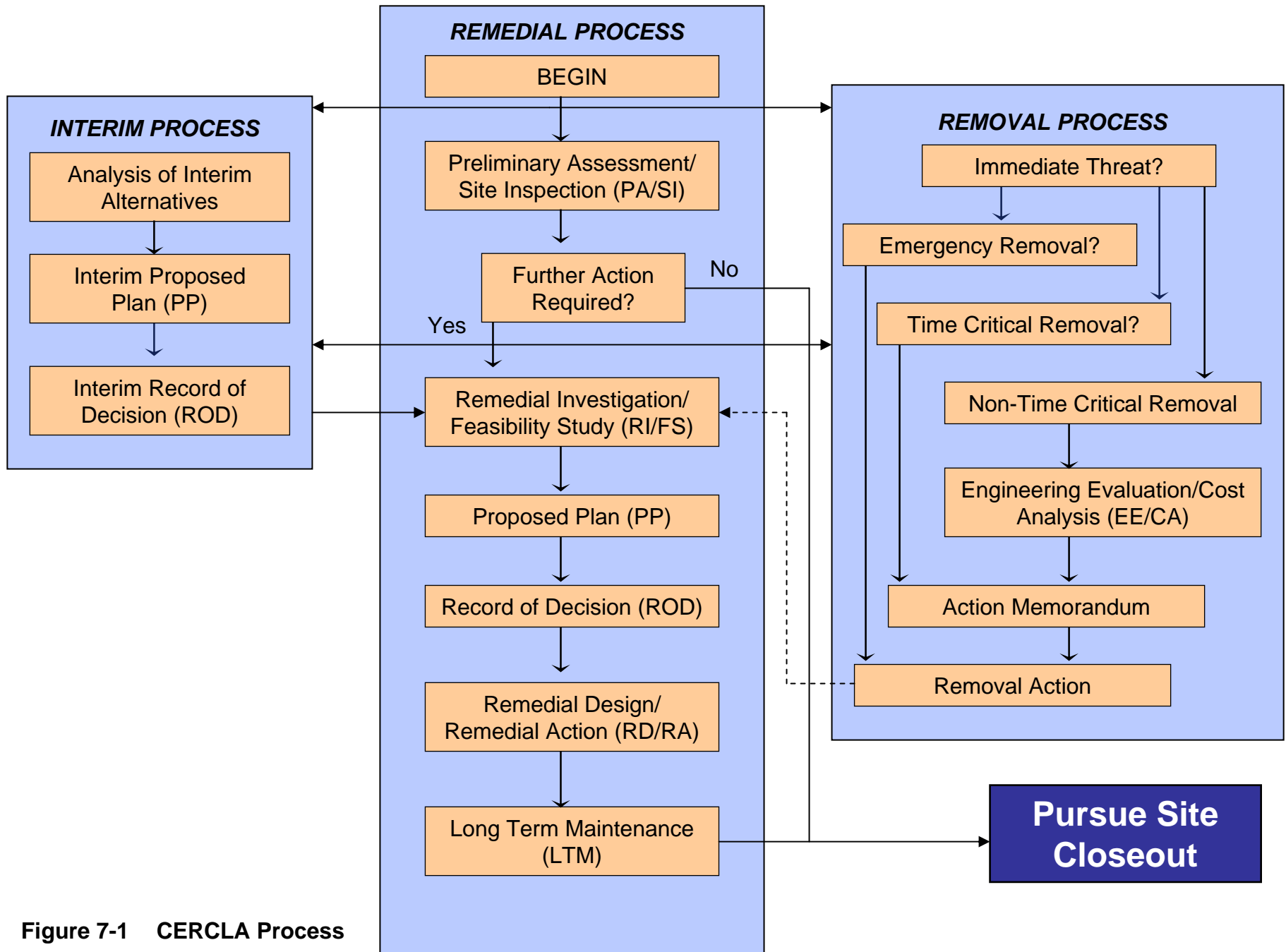







Figure 7-1 CERCLA Process

Figure 7-2 CERCLA Cleanup Master Flow-Chart

FORMER NANSEMOND ORDNANCE DEPOT MASTER PLAN (as of September 2005)																		
Project Op Unit	CALENDAR YEAR	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
02	MUNITIONS REMOVAL ACTIONS	EE/CA	RmA	RmA	RmA	RmA	RmA	RmA	RmA	RmA	RI/FS	ROD	RD/RA LUCIP	LTO/LTM	LTO/LTM	LTO/LTM	5 YEAR REVIEW	LTO/LTM
01 OU-5	TNT AREA Soil	RI	RI	RI	RI	RI	RI	RI	RI	RI	FS	FS	ROD	RD/RA LUCIP	LTO/LTM	LTO/LTM	5 YEAR REVIEW	LTO/LTM
	TNT AREA Ground Water	RI	RI	RI	RI	RI	RI	RI	RI	RI	RI	FS	ROD	RD/RA LUCIP	LTO/LTM	LTO/LTM	5 YEAR REVIEW	LTO/LTM
06 OU-2	MAIN BURNING GROUND (MBG)			RI	RI	RI	RI	RI	RI	RI	FS	ROD	RD/RA LUCIP	LTO/LTM	LTO/LTM	5 YEAR REVIEW	LTO/LTM	LTO/LTM
05 OU-3	HORSE-SHOE POND (HSP)			RI	RI	RI	RI	RI	RI	ROD	P-DELIST ELIGIBLE							
09 OU-1	JAMES RIVER BEACH FRONT (JRB)				EE/CA RmA	RI	RI	RI	RI	RI	ROD	P-DELIST ELIGIBLE						
10 OU-4	TRACK K DUMP (TIRE PILE AND PAINT CANS)				EE/CA RmA	EE/CA RmA	RI	RI	ROD	P-DELIST ELIGIBLE								
04 OU-7	IMPREGNITE KIT AREA					ROD	P-DELIST COMP											
15 POU-8	NANSEMOND RIVER BEACHFRONT (NRB)				EE/CA RmA	SI	SI	SI	SI	RI	FS	ROD	RD/RA LUCIP	LTO/LTM	5 YEAR REVIEW	LTO/LTM	LTO/LTM	LTO/LTM
11 OU-6	OFF SHORE STUDY			SLERA	SLERA	BERA	HHRA	ROD	AOC Close Out									
	NEAR SHORE JRB					BERA HHRA	BERA HHRA	BERA HHRA	Data to JRB									
	NEAR SHORE NRB / HSP						BERA HHRA	BERA HHRA	Data to NRB/HSP									
	INLAND LAKES J Lake and TCC Lake						SI	SI	SI	SI	RI	FS	ROD	RD/RA LUCIP	5 YEAR REVIEW	LTO/LTM	LTO/LTM	LTO/LTM
	GE POND NANSEMOND CULVERT							SI	SI	DD	AOC Close Out							
12 POU-9	GROUP B AOCs							SI	SI	RI	FS	ROD	RD/RA LUCIP	LTO/LTM	LTO/LTM	5 YEAR REVIEW	LTO/LTM	LTO/LTM
13 POU-10	GROUP C AOCs								SI	SI	RI	FS	ROD	RD/RA LUCIP	5 YEAR REVIEW	LTO/LTM	LTO/LTM	LTO/LTM
14 POU-11	GROUP D AOCs								SI	SI	RI	FS	ROD	RD/RA LUCIP	5 YEAR REVIEW	LTO/LTM	LTO/LTM	LTO/LTM

LEGEND	
	STUDIES
	DECISIONS/CLEAN UP
	LTO/LTM
	DELIST/CLOSE OUT
	WORST CASE

Nansemond River Beachfront includes AOCs 1, 13, 22, 23; NRB, WWTP, Renovation Plant, Arsenic Area

Off Shore, Near Shore, Inland Lakes includes AOCs 3, 5, 7; Off Shore and Near Shore Areas, TCC Lake, J Lake, GE Pond

Group B AOCs include AOCs 6, 10, 11, 12, 20; MCPG, Track H Scars, Track J Scars, Water Treatment Plant

Group C AOCs include 14, 15; Track K Scars, Track K Landfill

Group D AOCs include 2, 8, 9; Streeter Creek Scars, Track A Disposal Pit, Track A & B Burning Ground

AOCs Resolved include 4, 16, 18, 21; Steam Heating Plant, Suspected USTs, Officers' Pool

S-1 TNT Source Area

[OU-5]

Size: The TNT Source Area is approximately 9.8 acres in size.

Location: The TNT SA is located on TCC property at the intersection of College Drive and Jamestown Road.

History and Past Work: The TNT Area was identified in 1987 when evidence of munitions debris was found. The original work area was approximately 1.87 acres in size and enclosed by a fence. Subsequent investigation in the fenced area revealed a slab of crystalline TNT weighing several tons. Multiple remediation activities, as well as several rounds of soil and groundwater testing, have been conducted in the original TNT Area since the initial MEC find. The final boundaries of the TNT SA were established after evaluating historical aerial photographs and identifying suspicious topography (changes in elevation and disturbed areas) north of the original removal site. (*Archives Search Report*, ARF 01-13-066 F)

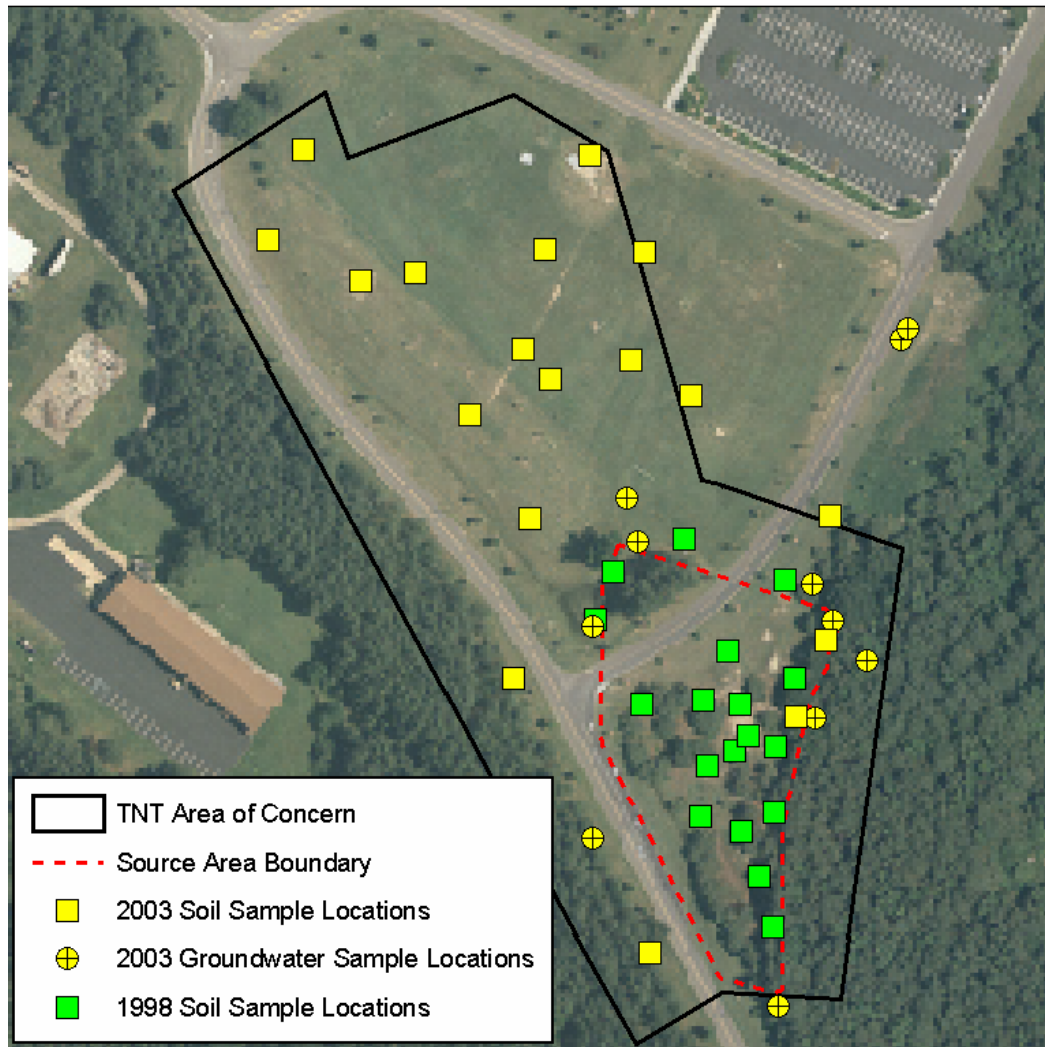
- In May of 1987, an MEC surface sweep was conducted. 10 lbs. of high explosives (TNT base), 170 lbs. of ordnance related material, and 400 lbs of scrap metal were collected and disposed of off-site. (*Appendix IX, Memorandum dated 15 May 1987*, ARF 01-12-001 F)
- During June and July 1987, a Remedial Action Investigation and Ordnance Survey was conducted. The investigation included a geophysical survey, test excavations, installation of monitoring wells (MWs), soil sampling and groundwater sampling. MEC was discovered in six out of 15 test excavations and included hundreds of 30 & 45 caliber rifle ammunition, explosive boosters, 100 to 150 cubic feet of crystalline TNT, scrap metal, burned out tear gas canisters, and fuses. Soil samples were collected from all 15 test pits and groundwater was collected from the MWs. Several CoCs were detected in the soil and groundwater. (*Engineering Report Groundwater Contamination*, ARF 01-12-001 F & *Engineering Report Ordnance Survey*, ARF 01-01-002 F)
- In December 1988, a surface and subsurface MEC clearance was conducted. MEC was removed from several of the previously identified pits as well as newly discovered pits. Contaminated soil was packaged and left on site for future disposal. A total of approximately 5,500 lbs of MEC was removed for the site. (*Final Report*, ARF 01-01-004)
- The contaminated soil left on site in 1988 was sifted to segregate hazardous and non-hazardous materials. The MEC was packaged and left on site. Part of the contaminated soil was returned to a lined pit and the remainder was packaged and left on site. (*Addendum to Final Report*, ARF 01-01-004)

- Between November 1989 and February 1991, an investigation (to be included in the 1992 Final Remedial Investigation (RI) for the TNT Area) was conducted to determine the physical characteristics of the site, define the extent of contamination, and assess potential pathways for contaminant migration. A total of thirty-five boring, ten surface, and 5 monitoring well boring soil samples were collected. Five new MWs were installed and groundwater from all 12 wells was tested. Several CoCs were detected in the soil and groundwater. (*Final RI*, ARF 01-13-031 #7)
- From April through June 1992, bagged, contaminated soil left on site after the 1988 and 1989 MEC investigations, as well as six inches of additional soil beneath the bags, was screened. The soil in the plastic-lined pit was removed along with 12 inches of soil beneath the liner and soil from adjacent drainage areas. The soil was screened and all MEC and contaminated soil were disposed of off-site. Confirmatory soil samples were collected from all excavations and of the CoCs present, concentrations were below regulatory limits. Approximately 435 tons of clean soil was used to backfill the excavations. A total of 316 tons of contaminated soil, 2800 gallons of non-hazardous water and 20 cubic yards of non-hazardous debris were removed and disposed of off-site. (*Contaminated Soil Removal*, ARF 01-13-070 F)
- In August 1994, five new MWs were installed, two existing wells were abandoned and one well was replaced. Monitoring well soil borings and groundwater were sampled. CoCs were detected in the groundwater. (*Groundwater RI*, ARF 01-05-004)
- During November 1998, soil samples were collected from 18 locations inside the original fenced area. CoCs were detected in several samples. (*Daily Report*, ARF 01-01-046)
- In May 1999, the Norfolk District entered into an IAG to perform a Time Critical Removal Action (TCRA) at several locations within FNOD, including the TNT SA. As a result of the IAG, a geophysical survey was conducted in July 1999 and several magnetic anomalies were discovered. (*Interagency Agreement*, ARF 01-08-005 & *Final Field Report*, ARF 01-01-048)
- From January 2000 until April 2001, an MEC removal was conducted based on the targets identified during the 1999 geophysical survey. Several pits in the TNT Area yielded assorted MEC, scrap metal, creosote and miscellaneous non-MEC waste (pipe, bricks, marston matting, utility pole). All items were removed and disposed of off-site. Additionally, twenty-five, 100-foot square grids in the TNT Area were investigated. Twenty tons of non-MEC scrap and 2 lbs. of MEC scrap were removed, in addition to adaptor boosters, fuses, TNT bags, raw TNT, small arms and rifle grenades. Solid TNT was discovered approximately 6 feet under ground and left in place until the MEC investigation was complete. (*Final Report MEC Removal*, ARF 01-13-094)

- During March and April 2003, soil and groundwater sampling was conducted to determine the extent of contamination between the perimeter of the original fenced area and the TNT SA boundary. Soil samples were collected at 18 locations and groundwater was collected from 14 MWs in and around the SA. (*Technical Evaluation*, ARF 01-13-107 v1)
- In June 2003, solid TNT, discovered during the earlier grid investigations, was excavated, and approximately 500 pounds of TNT was removed. The soil overlaying the TNT was tested using the Toxicity Characteristics Leachate Procedure (TCLP). Several compounds exceeded TCLP regulatory limits, resulting in the soil being classified as hazardous waste. However, the soil surrounding the excavation was known to be equally contaminated. As a temporary solution, the excavation was lined and the soil returned to the pit.
- A Time Critical Removal Action Memorandum was implemented to address the contaminated soil left in place after the June 2003 removal. The TCRA resulted in a temporary cap, which consisted of a 6-inch deep layer of topsoil placed over a geofabric. The temporary cap is intended to protect human health and the environment until the RI/FS is completed. (*Draft Action Memorandum dated 15 October 2003*, ARF 04-02-005)
- The Draft Human Health Risk Assessment and the Draft Screening Level Ecological Risk Assessment, using validated 1998 and 2003 analytical results, were issued in the summer of 2005. These documents are currently being reviewed by the Project Delivery Team.
- The Draft Field Sampling and Analysis Plan (FSAP) for the Groundwater Remedial Investigation was submitted to USACE in August 2005. The FSAP has been reviewed by USACE and comments are being incorporated into the document.

Future Work: The MEC investigation at the TNT Source Area is complete. The TCRA Final Report will be issued after MEC investigations at the remainder of the TCRA areas are concluded (Section 8 – Time Critical Removal Action) and the primary Interim Land Use Control agreements are put in place. A Draft Version of the TCRA Report is currently under development. The approved HHRA and SLERA will be incorporated into the Remedial Investigation. A Draft RI will be submitted during FY06 and used as the basis of a Feasibility Study, tentatively scheduled for FY07. The Draft Groundwater RI is scheduled for submission during FY06.

TNT Source Area - 2003 Soil and Groundwater Sampling Locations



S-2 James River Beachfront (JRB)

[OU-1]

Size: The James River Beachfront (JRB) SA is approximately 14 acres in size.

Location: The JRB is located on the south bank of the James River on the TCC property directly west of the Interstate 664 Monitor Merrimac Memorial Bridge-Tunnel.

History and Past Work: The JRB is identified as Source Area 2 in the Final HRS Package. The site is an approximately 500-foot section of shoreline that sharply transitions into a bluff. It was used as a general disposal site during World War I. Prior to a removal action during the summer of 2001, the bluff eroded significantly, exposing large amounts of debris – scrap metal, concrete slabs, bricks and other construction debris. Presently, the bluff is covered with grass and is stabilized by a stone revetment. At the base of the revetment, a sandy beach gently slopes to the water line. (*Archives Search Report*, ARF 01-13-006 F)

- USACE St. Louis District performed a visual inspection in November 1993 and found construction debris, concrete, bricks, water and sewer pipes, six inert 170 mm German artillery rounds, three inert artillery fuses, and containers of various sizes similar to chemical agent storage and transport containers. The materials were found on the beach and protruding from the bluff. (*Archives Search Report*, ARF 01-13-006 F)
- Roy F. Weston (Weston) conducted a removal assessment for EPA Region III in November and December 1995. Ordnance was examined for potential hazards; soil was field screened for Explosives; soil was analyzed for BNA, Explosives, TAL & TCLP Metals and Asbestos; a geophysical survey was performed to delineate the disposal area; and a surface clearance and subsurface survey were conducted by Navy Explosive Ordnance Disposal (EOD). (*Final Report Nansemond Ordnance Depot Site Removal Assessment*, ARF 01-13-012 F)
- Foster Wheeler conducted site visits, in conjunction with an Engineering Evaluation/Cost Analysis (EE/CA), in November 1993, December 1993 and January 1996. Building and civilian debris, 170 mm German artillery rounds and rusted containers were observed. Geophysical and Unexploded Ordnance (UXO) investigations indicated the presence of “extensive disposal areas containing metallic debris.” Foster Wheeler recommended surface MEC clearance and Institutional Controls followed by periodic surface sweeps. (*Final EE/CA*, ARF 01-04-012-F)
- During a June 1996 site reconnaissance the previously observed debris was still present. Additionally, small canisters were discovered. The canisters appeared to be conglomerated by burning and were labeled "Explosive Danger." (*Trip Report*, ARF 01-02-002)
- The Norfolk District installed a chain-link fence around the beachfront area in 1996 and repaired the fence in 1999 and 2000.
- USACE Baltimore District conducted an SI in 1998. Soil and groundwater sampling was performed to determine the presence (and levels), or absence, of contamination

and provide recommendations for remedial action. Contaminants of Potential Concern (COPCs) were identified in the subsurface soil, surface soil, and groundwater. Furthermore, Trichloroethene (TCE) was detected in upgradient Background Wells at levels exceeding the Maximum Contaminant Level (MCL) and Tapwater RBC screening criteria. Based on current and future use of the JRB, Baltimore District recommended closing the landfill in place and installing permanent shoreline stabilization. They also indicated the need for further investigation of the TCE contamination, which is discussed in section A-19. (*Final Site Investigation Report*, ARF 01-13-027-F)

- Weston, for Baltimore District, developed risk-based remedial (cleanup) goals (RGs) and the method for demonstrating compliance with the RGs through confirmation sampling. (*Risk Based Cleanup Criteria*, C03VA004509 02.16 0004 A)
- In May of 1998, human bones were unearthed during construction of an access road. The bones were determined to be more than 100 years old. In August 2000, Norfolk District conducted a phase I and II level archaeological test in the vicinity of the human burial. Artifacts dating from the late 1800's to the early 1900's were recovered and the site was formerly designated number 44SK481. No other human burials were found and the project archaeologist recommended no further work be conducted at the site other than removing the original human remains. The Virginia Department of Historic Resources issued a permit to remove the burial on 4 June 2001. The remains were removed during June of 2001 and re-interred at an alternate location. (*Result of Excavation*, ARF 06-01-035)
- A removal action was completed during the summer of 2001. Debris was removed, confirmatory geophysics was performed, anomalies were located and removed, confirmatory samples were collected and a stone revetment was constructed. The remedial goals were met for the beachfront and shoreline subunits. The RGs for protection of human health were met for the upland bluff subunit, but RGs for ecological receptors were not met. Therefore, an additional 30-foot by 90-foot area of the upland bluff was excavated to a depth of 2 feet and replaced with off-site fill material. MEC items found and removed included several 170 mm German projectiles, one 8-inch projectile and a cannon ball, none of which were fuze or contained explosives. (*Removal Operation Final Technical Report*, ARF 01-13-082 F).
- In early June 2003, a geophysical survey of the JRB nearshore was conducted, as part of the Environmental Characterization study, to detect submerged anomalies. This information was used to suggest locations for sediment coring. A follow-up survey was conducted in February 2004 to assess the nearshore after hurricane Isabel and update the coring locations, as needed. (*Survey Report*, ARF 01-13-118)
- During June 2004, twelve sediment cores, up to 10 feet in length, were collected from the JRB nearshore and submitted for chemistry and toxicity analyses. Results will be presented in the Geophysical Report (completion date – early FY05). (*Field Report*, 04-01-012.10)

- The Final Geophysical Report on the 2003/2004 nearshore investigation was issued in June 2005.
- The Final Screening Level Ecological Risk Assessment was issued in October 2005.
- The Human Health Risk Risk Assessment is scheduled to be issued in the fall of 2005.

Future Work: The HHRA, SLERA, and validated groundwater data collected in conjunction with the TCE AOC (AOC 19) will be incorporated into the RI Report. A strategy document is currently being developed for shoreline stabilization at the JRB. If necessary, shoreline stabilization will be addressed in the FS part of the RI. The Draft RI is tentatively scheduled for completion by the end of FY06.

S-3 Impregnite Kit Area

[OU-7]

Size: The Impregnite Kit SA originally encompassed a rectangular area approximately 7 acres in size. Subsequent activities resulted in the Project Delivery Team agreeing to reduce the area to a 1.66-acre circle, approximately 207 feet in diameter. (*Meeting Minutes dated 9 May 2002*, ARF 04-01-010)

Location: The Impregnite Kit SA is located south of the GE Plant on Dominion Lands property in a partially wooded area.

History and Past Work: This SA was a disposal area for Impregnite Kits. The kits contained XXCC3 and an inert, viscous liquid. XXCC3 is a compound used to neutralize chemical agents, and the kits were likely used as a protective coating on undergarments for military issue chemical suits. (*Final HRS Package*, ARF 01-13-031) These kits are not considered a Resource Conservation and Recovery Act (RCRA) Hazardous Waste as defined by the Material Safety Data Sheets.

- In March 1996, Malcolm Pirnie, for Dominion Lands, conducted an environmental screening of several parcels, including the Impregnite Kit SA. The screening consisted of a visual inspection, an MEC investigation and soil sampling. Excavation uncovered wooden crates, small metal cans and fiber drums. Labels identified containers found in the crates as Impregnite Kits. Surface and subsurface soil samples were collected. (*Environmental Screening Investigation*, ARF 01-13-013)
- Both Weston and Gannett Fleming conducted soil and waste sampling in February 1997. (*Final HRS Package, References 24 & 32*, ARF 01-13-031)
- In December 1998, 860 tons of Impregnite Kit materials and soil were removed and transported to a solid waste landfill. (*Final Remediation Report*, ARF 01-12-002 F)
- In July 1999, a confirmation geophysical investigation was performed and confirmation soil samples were collected. 16 magnetic anomalies were identified during the geophysical survey. One magnetic anomaly (Anomaly 1) was not investigated due to its large size. The remainder of the anomalies consisted of rebar, wire, pipes and miscellaneous ferrous items. One soil sample adjacent to the Horseshoe Pond (HSP) SA contained Arsenic at a level exceeding screening criteria; however, the HSP SA was expanded to incorporate this soil sampling location, and it will be investigated in conjunction with the HSP. The remaining confirmation soil samples indicated that no further cleanup actions were required. (*Meeting Minutes dated 6 December 2001*, ARF 10-01-001 & *Confirmation Sampling Report*, ARF 01-01-049)
- In August 2002, Anomaly 1 was investigated and found to contain approximately 10 pounds of non-MEC scrap and one item of MEC scrap. (*Weekly Report*, 4 – 10 August 2002, Zapata Engineering)
- In October 2002 the confirmatory soil sample results were validated, and it was recommended that No Further Action was required for soil in the Impregnite Kit SA.

Furthermore, it was discovered that the Arsenic level thought to exceed screening criteria, and added to the HSP SA, was a matrix spike result and not the primary sample result. (*Post Removal Action Confirmatory Sampling Report*, ARF 01-13-101)

- On 20 March 2003, the EPA Region III issued a Notice of Intent for Partial Deletion stating:

“The portion of the site to be deleted from the NPL is the soil in the Impregnation Kit Area... Only soil in this area is being deleted from the NPL; ground water beneath the Impregnation Kit Area will not be deleted at this time. A notice of intent to delete this portion of the site was published January 21, 2003 (68 FR 2726). The closing date for comments on the notice of intent to delete was February 20, 2003. EPA received no comments.” (*Partial Deletion Docket*, ARF 01-13-106)

- There is no Proposed Plan or ROD for the closeout of this site. Although the Norfolk District began a Proposed Plan and ROD to close out the site, EPA Region III chose to proceed directly with delisting using the Confirmation Sampling Report.

Future Work: Investigation into possible groundwater contamination is ongoing in order to determine if further groundwater characterization is required at the site.

S-4 Horseshoe Pond (HSP)

[OU-3]

Size: The Horseshoe Pond SA is approximately 1.2 acres in size.

Location: The HSP is located on Dominion Lands southwest of the GE Plant and adjacent to the Nansemond River.

History and Past Work: The HSP is a pond surrounded by berms and steep banks. It was apparently used as a waste disposal area for approximately 10 years beginning in the late 1940's. Laboratory glassware, bottles, film, and assorted debris are visible in the vicinity of the pond. (*Final HRS Package*, AFR 01-13-031) Unconfirmed information suggests that a Pistol and Small Bore Range covered an area, approximately 400 feet by 600 feet, on the southeastern arm of the HSP and overlapped the water. This SA contains wetlands that preclude development.

- During a June 1996 site reconnaissance, the glassware, film and other debris was observed. Also, a geophysical survey was conducted in 1996 over a 30-meter by 30-meter grid at the north end of the HSP. Twenty-four of the 36 detected anomalies were investigated and none were found to be MEC-related. However, two M-18 smoke grenades were found on the surface. (*Trip Report*, ARF 01-02-002 & *Final EE/CA*, ARF 01-04-007 F)
- In February 1997, Weston, for EPA Region III, collected soil, sediment and surface water samples and sampled probable waste sources in the drainage system. (*Draft Remedial Investigation Report*, ARF 01-05-008)
- Between November 1999 and April 2000, an initial RI was conducted at the HSP, Main Burning Ground and Steamout Pond AOCs. The initial RI included sampling of soil, sediment, surface water and shallow groundwater and a limited geophysical investigation. The draft RI Report identified several data gaps. (*Revised Draft RI Report*, ARF 01-05-008)
- In August 2002, Anomaly 1, originally part of the Impregnite Kit Area and added to the HSP SA, was investigated and found to contain approximately 10 pounds of non-MEC scrap and one item of MEC scrap. (*Weekly Report*, 4 – 10 August 2002, Zapata Engineering)
- During the Impregnite Kit confirmatory sampling data validation process, it was discovered that the Arsenic level thought to exceed screening criteria, and added to the HSP SA for further investigation, was a matrix spike result and not the primary sample result. (*Post Removal Action Confirmatory Sampling Report*, ARF 01-13-101)
- A Supplement to the RI addressing the RI data gaps was completed in 2003. The SRI included an expanded geophysical investigation of previously inaccessible areas of the HSP, investigation of test pits, and additional surface and vadose zone sampling. A Revised Draft RI Report, including validated analytical results and a Baseline Human Health Risk Assessment, was issued in July 2003. (*Supplement to the*

Remedial Investigation Report, ARF 01-05-009 and Revised Draft RI Report, ARF 01-05-008)

- Soil collected from the berm and tidal marsh sediment were evaluated to determine if a pathway exists between the HSP and nearshore area adjacent to the Nansemond River; however, the evidence was inconclusive. (*Technical Memo, ARF 01-05-010*)
- During the SRI field investigation, two significant subsurface anomalies, one having a ferrous component, were discovered in the HSP. In order to access the anomalies for further investigation, the HSP must be dewatered. Surface water sampling was conducted in July 2004 in order to determine the appropriate method for handling the water when the pond is drained for the anomaly investigation. Sampling results were reviewed, and it was determined that the surface water could be discharge to the wetlands and into the Nansemond River.
- The Human Health Risk Assessment was completed in FY04.
- A Baseline Ecological Risk Assessment is currently underway in order to determine if a pathway exists between the HSP and the nearshore area. The Draft BERA was submitted in August 2005 and is currently under review.
- During the summer of 2005, the pond was drained in order to investigation the two anomalies identified during the SRI. The two anomalies were found to be a metal pipe and wire that was not munitions-related.
- An investigation into the occurrence of arsenic in groundwater was performed in FY05. The results indicated elevated levels of arsenic in groundwater in some wells to the Northeast of HSP. These arsenic detections are not considered to be related to the HSP and they are currently being investigated under as new Area of Concern (AOC-22).

Future Work: The Draft BERA and Remedial Investigation are scheduled to be finalized in FY06. The results of the RI will determine if further action is necessary at the HSP.

S-5 Main Burning Ground (MBG) and Steamout Pond (SP)

[OU-2]

Size: The Main Burning Ground (MBG) is approximately 32 acres. The Steamout Pond (SP) is located in the Main Burning Ground and is approximately 1 acre.

Location: The MBG is located in the eastern half of FNOD on GE Property. It is southeast of the GE Pond and south of Wellner (formerly Park) Drive.

History and Past Work: The MBG appeared active from at least 1942 until the late 1950's, first as a burning ground or test area, then as a waste disposal area. The MBG was characterized by ground scars, mounded material, pits, trenches, equipment, and a small structure. The Steamout Pond first appeared as an excavation in the eastern half of the MBG in 1952. Access roads and trenches led to the Steamout Pond. In 1958, it was filled with a dark liquid and fed by a ditch containing a similar liquid. By 1963, the area appeared inactive and was becoming re-vegetated. Currently, the MBG is partially wooded and the SP, while smaller than it's original size, remains visible and is lined with a black, tar-like material. (*Site Analysis Report*, ARF 01-01-003 & ARF 05-01-003; *Historical Photo Analysis*, ARF 05-01-005)

- In conjunction with the EE/CA issued in 1998, a geophysical survey, test pits, and soil sampling were completed at the MBG and SP. Trenches were identified and MEC, MEC related items, and burn layers were discovered. (*Final EE/CA*, ARF 01-04-007-F)
- In February 1997, Weston and Gannett Fleming, representing EPA Region III, collected soil, sediment and water samples from the MBG and SP. (*Site Sampling Plan*, February 1997, ARF 02-03-020 and *Analytical Report*, April 1997, ARF 07-02-033; *Revised Draft RI Report*, ARF 01-05-008)
- An MEC investigation and removal action began in February 2000. During incineration, MEC may have been propelled some distance beyond the MBG boundary when explosions occurred. Therefore, the boundaries for the MEC investigation were extended beyond the MBG in order to include this "kick-out" area (two additional parcels designated Dominion Lands I and Dominion Lands II located southeast and south of the MBG, respectively). The Dominion Lands I & II clearances are complete. As of August 2005, the majority of MBG grids are complete and the remainder of the work is ongoing.
- Between November 1999 and April 2000, an initial RI was conducted at the HSP, Main Burning Ground and Steamout Pond AOCs. The initial RI included sampling of soil, sediment, and water and a limited geophysical investigation. The draft RI Report identified several data gaps. (*Revised Draft RI Report*, ARF 01-05-008)
- A Supplement to the RI addressing the RI data gaps was completed in 2003. A Revised Draft RI Report, including validated analytical results and a Baseline Human Health RA, was issued in July 2003. (*Supplement to the Remedial Investigation*, ARF 01-05-009)

- Several Hazardous, Toxic and Radioactive Waste (HTRW) issues have arisen during the MEC investigation at the MBG. These issues are detailed in Section 8, Potential HTRW Issues.
- A Human Health Risk Assessment was completed in FY04.
- A Draft Baseline Ecological Risk Assessment was submitted in March 2005 and is currently under review.
- A Draft Work Plan/ Field Sampling Plan to determine the presence or absence of munitions constituents was submitted in August 2005, and is currently under review.

Future Work: The MEC investigation and removal is ongoing. HTRW issues are investigated as they are discovered. Following the MEC investigation (anticipated completion date based on current funding levels - FY06), and further investigation of HTRW issues, the RI will be finalized.

S-6 Track K Dump (Tire Pile and Paint Can Area)

[OU-4]

Size: The Track K Dump SA consists of a Tire Pile and Paint Cans. The Tire Pile is approximately 1/2 an acre in size (250 feet by 100 feet) and the Paint Cans scattered over a circular area approximately 12 feet in diameter.

Location: The Track K Dump is located west of South Road in an unused, wooded area of TCC.

History and Past Work: The Track K Dump was part of the Track K line of magazines and the tires and paint cans were piled on and around an old magazine foundation. The HRS Package states that, based on evaluation of historical aerial photographs, disposal of the tires and paint cans likely occurred between the mid-1970's and early 1990's when DOD no longer owned the property. However, the tires and paint cans were removed to access soil in the vicinity of the former K-6 magazine and investigate possible contamination. (*Final Work Plan*, ARF 02-01-018 F)

- In 1997, one soil sample was collected from the site and indicated the presence of CoCs at concentrations higher than nearby background concentrations. (*Final HRS Package*, ARF 01-13-031)
- In April 2001, HydroGeoLogic, Inc. was contracted to survey the tire pile and paint can locations, conduct a removal operation, collect post-removal confirmatory sampling, and apply the SSP to the samples results. (*Final Work Plan*, ARF 02-01-018 F)
- A removal operation was conducted during May and June of 2001. Prior to the removal action, an MEC surface sweep was conducted and the area was found safe. The following items were removed and disposed of in a local landfill - approximately 60 tons of tires; six rusted, 1-gallon, empty paint cans; appliances; household waste and construction debris. (*Summary of Tire Pile Removal*, ARF 01-13-076) Five confirmatory soil samples were collected from the tire pile area and from the paint can area, and several CoCs were identified. Based on the confirmatory soil sample results, background information and nature of waste found at the Track K Dump, groundwater contamination is considered unlikely and will not be investigated. (*Interim SSP Report*, ARF 01-013-110 v1)
- In February 2002, additional surface and subsurface soil sampling was performed to further characterize the nature and extent of contamination. (*Interim SSP Report*, ARF 01-013-110 v1 and *Data Validation Report*, ARF 07-01-013)
- In March 2002, a representative from the Virginia Department of Environmental Quality inspected the Track K Dump and certified that the tire pile clean up complied with stated regulations. (*Letter, dated 8 April 2002*, ARF 04-01-010)
- Delineation soil samples were collected in 2004 and the analytical results were validated.

- The Final RI Report was issued in September 2005. The results of the HHRA and the SLERA indicated that the site did not pose an unacceptable risk to human or ecological receptors.
- A Draft Proposed Plan recommending No Further Action was submitted for regulatory review in August 2005.

Future Work: The Public Meeting is tentatively scheduled for December 2005, based on regulatory review of the Draft Proposed Plan. Comments on the Proposed Plan will be addressed in the Record of Decision for the site, which is scheduled for development in FY06.

A-1 Nansemond River Beachfront (NRB)

[POU-8]

Size: The Nansemond River Beachfront (NRB) AOC is approximately ¼ of an acre in size.

Location: The NRB is located northwest of GE along the Nansemond River on TCC property. It includes a beach and rocky bluff approximately 150 feet in length.

History and Past Work: The NRB was listed as an AOC due to the presence of metal slag of questionable content. Evaluation of aerial photos indicates evidence of ground disturbance in the area, but the origin of the disturbance is unclear. The NRB is adjacent to several former depot structures including a Wastewater Treatment Plant.

- In October 1997, three soil samples were collected in conjunction with the EE/CA. TNT was detected in one sample. (*Final EE/CA*, ARF 01-04-012-F)
- In September 1999, the Norfolk District repaired a fence restricting access to the NRB. (*Memorandum dated September 1999*, ARF 04-01-007).
- Site visits conducted on 7 and 30 September 1999, in conjunction with a Desktop Audit of the NRB, revealed an eroded narrow shoreline stabilized with riprap. Debris found on the beachfront and protruding from the embankment included bricks, glass, ceramic items, asbestos siding, trash, steel rods, slag, ammunition rounds and an unidentified brown friable material. The majority of the items appeared to have been burned prior to disposal. (*Desktop Audit*, ARF 01-13-053 v1)
- In February of 2000, MicroPact and Gannett Fleming (representing Norfolk District and EPA Region III, respectively) sampled shallow subsurface soils, the brown friable material and slag. (*Technical Report*, ARF 01-13-111 v1)
- During April, May and June of 2000, Science Applications International Corporation (SAIC) conducted a 3-phase offshore investigation, which included a geophysical survey, sediment profile, and sediment sampling. Three sediment sample locations were in the proximity of the NRB, two being near potential onshore sources (HSP and GE Pond outfalls). (*Findings of an Environmental Survey*, ARF 01-01-055 F)
- During the summer of 2001 a removal operation was conducted at the NRB. Large stone and concrete rubble was moved aside to expose the underlying soil, which was excavated. Slag and metal debris were removed by hand. The soil was returned to the slope and the rubble replaced. Exposed sections of the beachfront were inspected and all the slag and metal debris was removed. Two weeks later, additional slag was detected under the concrete rubble. The rubble was moved and a one-foot-depth section of soil was excavated and disposed of in an off-site landfill. Confirmatory geophysics were conducted on the exposed section of the NRB. All anomalies were investigated and removed.

Prior to disposal, four samples were collected from the slag waste material and soil and analyzed for TCLP Metals. None exceeded the EPA regulatory limit for TCLP metals (40 CFR, 261.24, Toxicity Characteristic, Table 1, Maximum Concentration of

Contaminants for the Toxicity Characteristic) (*Removal Operation Final Technical Report*, ARF 01-13-082 F).

- On 15 and 22 August 2001, Gannett Fleming (for EPA Region III) conducted post-removal confirmatory soil sampling. Four surface soil samples were collected - two from an area under the former location of the brown friable material and two from an area under the removed rip rap where melted glass “vials” were discovered. (*Technical Report*, ARF 01-13-111 v1)
- In June 2003, during a routine inspection of the NRB, a British 6-inch shrapnel round was found. The round was not fused but contained a live (low explosive) expelling charge in the base. Zapata Engineering removed and disposed of the MEC. (*Technical Report*, ARF 01-13-111 v1)
- In July 2003 Reactives Management Corporation performed a clean up of surface slag, exposed as a result of the eroding shoreline. Excavation of the beach was not performed. Only clearly visible slag accessible without the use of heavy equipment was removed. Approximately 820 pounds of slag was collected, placed into heavy garbage bags, and transported to the Southeastern Public Service Authority bi-metals plant for recycling. Some slag remained visible in the bank on the west side of the concrete drain pipe. It appears that when that portion of the bank further erodes the slag will tumble onto the beach. (*Technical Report*, ARF 01-13-111 v1)
- Debris was discovered, spread over a large area, during FY04. Storms tore down some of the remaining bulkheads exposing the soil. Upon visual inspection by Zapata personnel, it appears that the soil behind the former bulkheads was taken from another location within FNOD and used as backfill during bulkhead construction.
- A field investigation, including a shoreline geophysical investigation and environmental sampling was completed in 2005. A Draft SSP Report was submitted to USACE in August 2005 and comments are being incorporated.
- Due to the MEC discovery, the NRB is now considered an MEC site; therefore, an MEC investigation is scheduled for FY06. The Draft Workplan for MEC investigation at the NRB was submitted in August 2005.

Future Work: The MEC investigation in the vicinity of the NRB is scheduled for FY06. Additional investigation of the NRB nearshore may be necessary, based on the results of the SSP.

A-2 Streeter Creek and Lakeview Drive Ground Scars

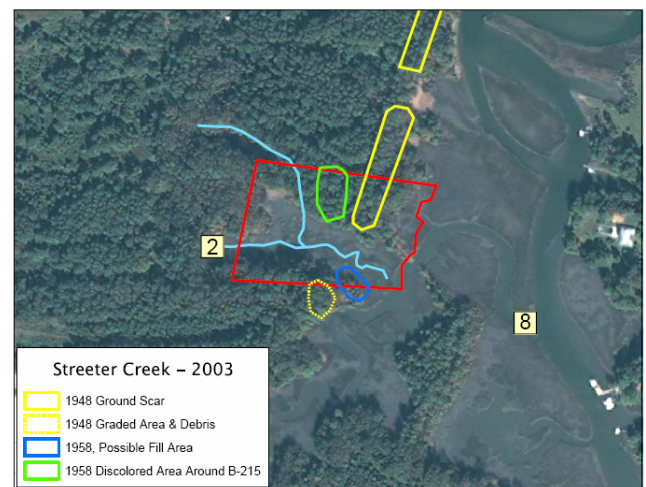
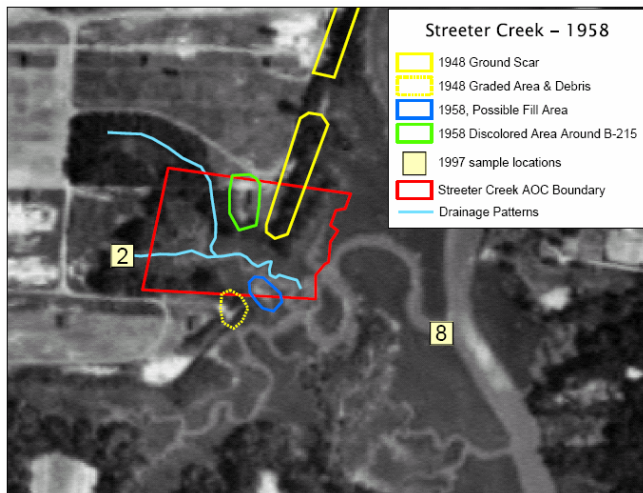
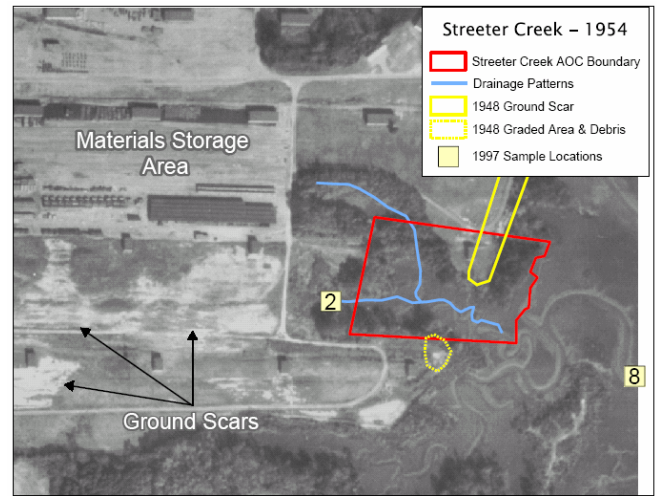
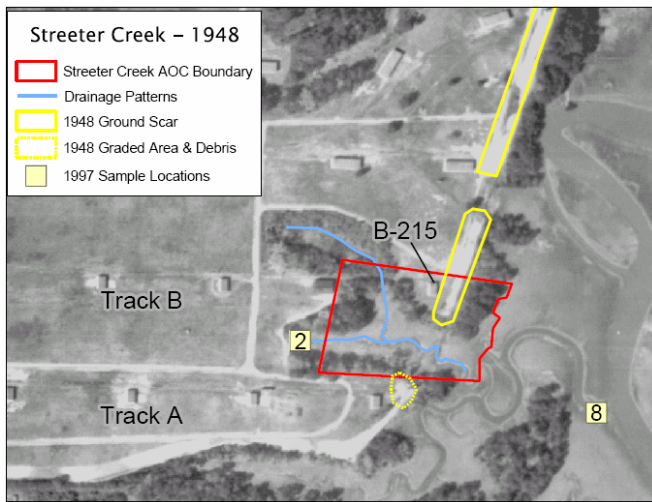
[OU-6]

Size: The Streeter Creek AOC is approximately 4.5 acres in size.

Location: The Streeter Creek AOC is located on TCC Property, along the eastern boundary of FNOD, between Interstate 664 and Streeter Creek, at the east end of former Tracks A & B.

History and Past Work: In 1948, a graded area and debris were identified just south of the AOC boundary, and a thin ground scar was observed near the western edge of the AOC. By 1954, a materials storage area was located northwest of the AOC and three large ground scars (Track A & B Burning Ground) were west of the AOC. In 1958, a possible fill area existed along the creek bank and a discolored area surrounded High Explosive Magazine B-215. Historical drainage patterns indicate that runoff from the materials storage area, ground scars and possible fill area entered the creek. (*Site Analysis Report*, ARF 01-01-003 & ARF 05-01-003 and *Desktop Audit*, ARF 01-13-058 F)

- In 1997, surface water and sediment samples were collected at two locations adjacent to the AOC and analyzed for VOCs, SVOCs, explosives, pesticides, PCBs, metals, and cyanide. Analytical results were validated and compared to Region III Residential Soil RBCs. Arsenic was detected in surface water (location 2) and sediment (locations 2 and 8) at concentrations exceeding the RBCs. Iron was detected in surface water (location 2) and sediment (location 8) at concentrations exceeding the RBCs. (*Analytical Report*, ARF 01-01-037)
- A site visit was conducted in July of 2000 and revealed dense patches of vegetation, two abandoned structures (former magazines) and debris (trash, construction debris, scrap metal). An unidentified structure (possible tank, and later determined to be pontoon assembly) was observed in the creek. Also, a hummocky area was located near the possible landfill seen in historical aerial photographs. (*Desktop Audit*, ARF 01-13-058 F)
- A Final Desktop Audit [Preliminary Assessment under CERCLA] was issued in April 2002 and concluded that additional data was needed to fully characterize the site and develop a CSM. The DA recommended installing staff gauges and monitoring wells; sampling groundwater, surface water, and sediment; performing slug tests on the MWs; and measuring water elevations. (*Desktop Audit*, ARF 01-13-058 F)
- In September of 2001, Norfolk District and EPA Region III representatives, accompanied by Industrial Marine Services (IMS), investigated the unidentified structure in Streeter Creek. Baffles and I-beam construction observed inside the structure led to the conclusion that it was a pontoon (possibly a support for a bridge spanning the creek). Investigators determined the structure was of no concern and left it in place for future removal. (*Memo for the Record*, ARF 06-01-065)
- In the fall of 2002, in support of the CSM, staff gauges and MWs were installed. Also, groundwater and soil samples were collected. A preliminary draft of the CSM was submitted to the Norfolk District in early 2003 for review and comment. The CSM was revised and issued in draft format during FY05.



Future Work: After investigating the contaminant sources, exposure pathways, and receptors identified in the CSM, an SI will be conducted and the AOC will be evaluated using the Site Screening Process.

A-3 Nearshore and Offshore Areas

[OU-6]

Size: The FNOD shoreline is approximately 2 miles long. The Nearshore AOC is the area extending from the existing shoreline to the Mean Lower Low water mark (MLLW). The Offshore AOC is the area from MLLW out to approximately 1 mile.

Location: The Nearshore and Offshore AOCs are north and northwest of FNOD.

History and Past Work: Three piers are known to exist while FNOD was in operation. A railroad pier projecting north, approximately 4800 feet, is shown on a 1925 oblique photo. A 1942 aerial photograph shows two additional piers, a railroad pier approximately 500 feet long and a pier (unknown function) approximately 780 feet long. During World Wars I and II, the railroad piers were used to load unserviceable ammunition on barges for disposal at sea. By 1963 the longer railroad pier was completely submerged. (Archives Search Report, ARF 01-13-006 F; Historical Photo Analysis, ARF 05-01-005; *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003) Several known or suspected disposal areas and burn pits are located on or near the shoreline (Horseshoe Pond, Nansemond River Beachfront, James River Beachfront). Significant erosion of the shoreline, up to 300 feet in some areas, occurred over the past 50 years and exposed assorted debris, including MEC waste, metal, slag, and construction materials. (*Survey of the Marine Offshore Areas*, ARF 01-01-055 F) Unconfirmed information suggests that at least one fire occurred on the mile-long pier.

- Navy divers explored the area around the mile long pier pilings in 1999. No ordnance or hazardous items were discovered at that time (*Survey of the Marine Offshore Areas*, ARF 01-01-055 F)
- In September 2002, SAIC issued their findings of an environmental survey of the Offshore. The survey was conducted in three phases beginning with a geophysical investigation, followed by sediment profile photography, and concluding with sampling of surface and core sediments. The goal of the survey was to characterize the sediment that supports marine life and identify anomalous lithologies that may be a result of past FNOD activities. The Offshore Survey did not include the Nearshore Areas, Streeter Creek, TCC Lake or the 500-foot (fishing) pier. (*Survey of the Marine Offshore Areas*, ARF 01-01-055 F)
- In September 2002, SAIC issued a Baseline Ecological Risk Assessment (BERA) using the results of the Offshore Survey. The BERA concluded that ecological risk from the Offshore Area was negligible and requires no remediation or further action. (*Baseline Ecological Risk Assessment*, ARF 01-13-064 F)
- In June 2001, potential MEC items were located by VDOT personnel during a geophysical investigation of future bridge locations. Navy EOD divers discovered the search area covered with wood, metal and concrete debris; however, no MEC or MEC related items were recovered. (*After Action Report*, ARF 01-13-084)
- In February 2004, a Screening Level Ecological Risk Assessment (SLERA) was issued for the fishing pier area. The SLERA concluded that ecological risk from the fishing pier

area was negligible and requires no remediation or further action. (*SLERA*, ARF 01-13-112)

- During FY04, a Record of Decision for the Offshore Area, documenting that No Further Action is needed at the AOC, was approved by the EPA. (*Record of Decision for the Offshore Area*, ARF 01-13-120)

Future Work: The Nearshore field investigation is complete and upon receipt of final results, a Baseline Ecological Risk Assessment will be conducted.

A-4 GE Pond and Culvert

[OU-6]

Size: The GE Pond is approximately 1 acre in size. The culvert is approximately 1700 feet in length.

Location: The GE Pond and Culvert are on General Electric property. The pond is located southeast of the main building and northwest of the MBG. The culvert begins at the northwest edge of the pond, travels north-, northwest under the parking lot and main building, and discharges into the Nansemond River just south of the NRB.

History and Past Work: The GE Pond was first observed on a 1931 aerial photograph as a shallow depression. By 1958, water filled the pond and it was connected to the Main Burning Ground by a suspected drainage structure. When GE purchased the property in 1966, the pond was functioning as a stormwater basin and would overflow and flood the parking lot during storm events. The culvert was constructed in the late 1960's to divert stormwater runoff from the pond. Stormwater overflow exits the pond through the culvert, which discharges directly to the Nansemond River. (*Draft Desktop Audit, October 2002, 01-13-108*)

- In February 1997, Weston, representing EPA Region III, collected sediment and water samples from the pond and culvert outfall. (*Site Sampling Plan, ARF 02-03-020 and Analytical Report, ARF 07-02-033*)
- GE contractor, Montgomery Watson Harza, collected sediment samples from the culvert outfall in December 2001. (*Sediment Results, ARF 07-02-032*)
- Surface water and sediment samples were collected in April and July of 2003. Surface water and sediment samples were collected from the pond, and sediment samples were collected from the suspected drainage structure leading from the MBG. The analytical results were validated and evaluated in accordance with the SSP. No compounds were detected above risk-based screening criteria in surface water. Sediment in the pond and the suspected drainage structure exceeded the screening criteria for some compounds (e.g. arsenic and vanadium). All other compounds were either not detected or detected at levels below the screening criteria. (*Draft Desktop Audit, October 2002, 01-13-108*)
- The Draft SSP Report was submitted for regulatory review in FY 05. Based on comments received on the Draft SSP Report, USACE is performing additional risk characterization in accordance with the SSP process.

Future Work: The Draft SSP Report will be revised to include the additional risk characterization, and is scheduled to be submitted in FY06.

A-5 Tidewater Community College Lake (TCC Lake)

[OU-6]

Size: TCC Lake is approximately 14 acres.

Location: TCC Lake is on TCC property west of Interstate 664 and adjacent to the James River.

History and Past Work: The TCC Lake AOC was originally a swampy creek draining into the James River. The lake was created when the creek was dammed and was a possible waste disposal area. (*Final HRS Package, Reference #33 - Data Acquisition Summary Report*, ARF 01-13-031) A water tank and pump house are located adjacent to the southeast bank of the lake. Several areas of debris (scrap metal, wood, glass, plastic bottles, household items, concrete) are located along the east side of the lake. Additionally, several pits, mounded areas, depressions and a possible man-made drainage feature are located on the east side of the lake. Eight explosives storage structures surrounded the lake while the depot was in operation (*Desktop Audit*, ARF 01-13-057). Paths leading through the woods from the Track K Ammunition Magazine Line and TCC Lake were observed in 1957. (*Historical Photo Analysis, March 1997*, 05-01-005) Analysis of past drainage patterns indicate that surface runoff entered the lake from the south and east. (*Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003).

- USACE performed a visual survey of the TCC Lake in November 1993. Construction debris was observed along the edge of the pond. An excavation, shored with railroad ties, was investigated on the east side of the pond; however, no debris or munitions were found. (*Archives Search Report*, ARF 01-13-006 F)
- An additional site reconnaissance was conducted in November of 1993. In addition to the items found earlier, more recently deposited debris (petroleum product containers) was found in one of the former magazines. (*EE/CA*, ARF 01-04-007 F)
- In November 1995, Weston, for EPA Region III, sampled soil from the excavation on the east edge of the lake and a trench near Track G, on the south side of the lake. (*Trip Report*, ARF 01-02-001)
- In January 1996, Gannett Fleming, for EPA Region III, conducted a site inspection; however, it was limited to a small area of the pond due to dense vegetation. (*Trip Report*, ARF 01-02-002)
- In February 1997, Weston, representing EPA Region III, collected sediment and surface water samples from TCC Lake. One compound exceeded screening criteria. All other compounds were either not detected or detected at levels below the screening criteria. (*Site Sampling Plan*, ARF 02-03-020 and *Analytical Report*, ARF 07-02-033)
- Gannett Fleming, for EPA Region III, conducted a multimedia sampling event from September through November 1997. Surface water, sediment and fish tissue were collected from the lake. (*Summary of EPA Sampling Efforts*, ARF 01-13-072)
- During 1997, a geophysical survey was conducted on the south side (Track G area), east side (ground scars between former K-6 & K-7 magazines) and northeast side (unidentified pits near former J-2 magazine) of TCC Lake. Magnetic anomalies identified and investigated included steel pipe, metal rods, nails, bolts, wire, cans, wire

fence, and other metallic debris. No potential UXO items were detected. Additionally, the lake bottom was surveyed by magnetometer and no anomalies were encountered. Soil from one of the pits surveyed on the northeast side of the lake was tested for Explosives and results were below the quantitation limit. (*EE/CA*, ARF 01-04-007 F)

- In March 2002 a Final DA was issued for the TCC Lake and identified several CoCs for further investigation. (*Desktop Audit*, ARF 01-13-057 F)
- VDEQ collected fish tissue and sediment samples in August 2000. The results indicated only low levels of contaminants commonly detected in fish tissue. After review by the Virginia Department of Health, it was concluded that the general public faces no health risks from consuming fish caught from TCC Lake. Also, two sediment samples were collected and found to have results below the VDEQ screening criteria. However, risk-based screening to determine the effect on human health or the environment was not conducted and not all CoCs were analyzed for. (*Fish Tissue and Sediment Results*, ARF 07-03-009)
- In early June 2003, SAIC performed a geophysical survey of the TCC Lake in support of the Environmental Characterization study. The survey revealed the presence of large metal objects, believed to be debris, clustered in several areas of the lake and several small, isolated targets spread throughout the lake. (*Survey Report*, ARF 01-13-118)
- SAIC evaluated results from the 2003 geophysical survey and past sampling events (surface water, sediment and fish tissue sampling) in order to determine if sufficient data exists to accurately evaluate the AOC. Findings were documented in the *Strategy Document: Risk Screening and Closeout Strategy* (ARF 01-13-119). SAIC concluded that the preliminary data suggests the possibility that contaminants related to historic FNOD activities may be present in TCC Lake at levels which may present risks to aquatic life and the environment; however, insufficient data exists to determine what action, if any, is required.
- The Final SLERA was issued in October 2005. The SLERA determined that there were several exceedances of risk-based criteria in sediment, but much of the data did not meet data quality objectives (DQOs).
- Based on the results of the SLERA and other data collected for the site, it was determined that Ecological and Human Health Risk Assessments are warranted for the site. A Workplan for conducting the ERA and HHRA was finalized, and samples were collected in July 2005.

Future Work: The ERA and HHRA Reports are currently being developed and are scheduled to be finalized in FY06. The results of these Risk Assessments will be used to determine if further action is required at the site.

A-6 Marine Corps Power Generation Plant

[POU-10]

Size: The power generation facility is approximately 2300 square feet.

Location: This AOC is located northeast of the intersection of Armistead Road and College Drive.

History and Past Work: The power generation building housed a day tank used to fuel a generator, which powered a boiler system. A 12,000-gallon Above Ground Storage Tank (AST) was located outside the building on the east side. A transformer switch, possibly containing PCB-contaminated oil, is present on site and has not been investigated.

- In February 1999, EPA Region III issued a letter outlining Corps tasks requiring immediate attention. Item 2 was removal of the AST and its contents. (*Letter dated 11, ARF 04-01-007*)
- In April 1999, a Norfolk District contractor removed the 12,000-gallon AST, day tank and fuel lines. Soil samples were collected and tested for Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DRO), PCBs and Metals. TPH-DRO, PCBs and Metals concentrations were below detection limits. (*Closure Report, ARF 01-13-041*)
- In 2003, the oil located inside the building was tested for PCBs, metals, and mercury and removed to a proper disposal facility by MicroPact Engineering. Documentation will be included in the Site Screening Process Report.
- The work plan for environmental sampling and asbestos characterization was approved during FY04. The results of this sampling will be documented in the SSP Report.
- In accordance with the SSP, a field investigation, including surface soil, subsurface soil, and groundwater sampling, was conducted in FY05. The Draft SSP Report was submitted to USACE in 2005 and comments are currently being incorporated.

Future Work:

The Draft SSP Report will be submitted for Regulatory Review in early FY06 and is scheduled to be finalized later in FY06. The results of the SSP Report will determine if further action is necessary at the site.

A-7 J-Lake

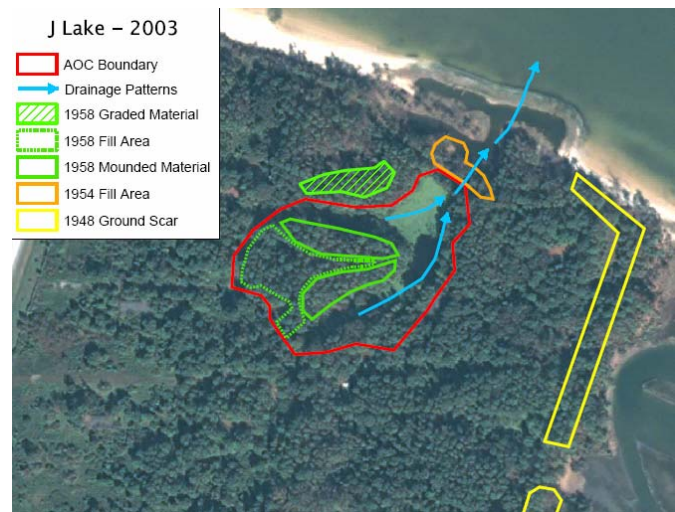
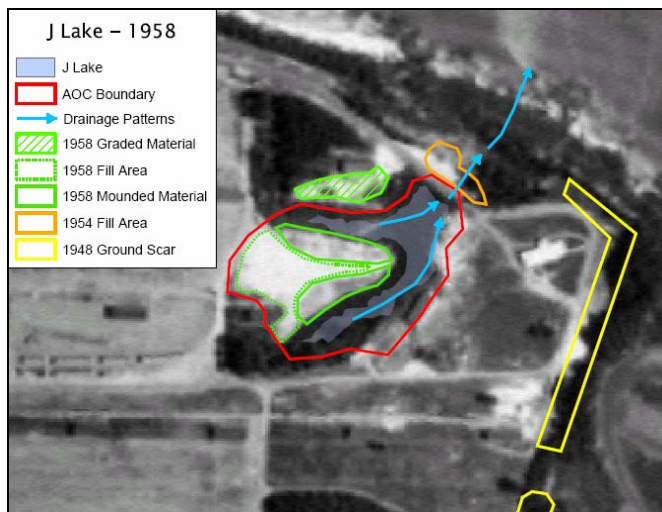
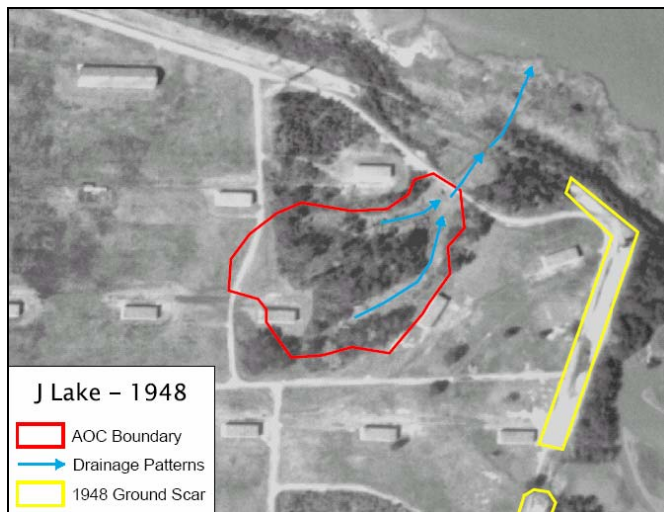
[OU-6]

Size: In addition to the lake and adjacent wetlands, the AOC includes the woods surrounding and bounded by the forks of the lake, for a total of approximately 5.3 acres.

Location: J-Lake is located between Interstate 664 and Streeter Creek, approximately 500 feet from the James River.

History and Past Work: In 1948, four Smokeless Powder Magazines surrounded wetlands, that would later become J-Lake, and ground scars were located east of the wetlands. By 1954 a fill area in the northeast section of the wetlands resulted in the lake being formed, and a materials storage area was located west of the lake. In 1958, a possible 55-gallon drum storage area was observed in the materials storage area; mounded material was located between the forks of the lake; graded areas and fill areas were northeast and west of the lake. (*General Map dated January 1937*, ARF 05-02-023 and *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003)

- In 1997, a geophysical survey was performed in the wooded area bounded by the lake where the mounded material and graded and filled areas were formerly located. Twenty-two of 57 anomalies were investigated, but none were MEC related (*EE/CA*, ARF 01-04-007-F).
- Also in 1997, Gannett Flemming conducted multimedia sampling in the J-Lake area, which included surface water, sediment and fish tissue samples. (*Desktop Audit*, April 2002, MicroPact)
- A Desktop Audit was issued in 2002. It identified COPCs for the surface water, sediment and fish tissue based earlier sampling efforts. The COPCs were identified as arsenic, several semi-volatile organic compounds and pesticides.
- During July 2003, SAIC performed a geophysical survey at the J-Lake AOC. (*White Paper dated 28 August 2003*, ARF 04-01-11.2)
- A geophysical survey was conducted during June of 2004 in conjunction with the nearshore investigation of the JRB. Several targets, possibly debris, were identified in the lake. (*Survey Report*, ARF 01-13-118)
- The Final Survey Report Geophysical Report was submitted for J-Lake in January 2005. The report indicated that a large area of metal debris was identified in the middle portion of the lake. Further investigation may be required to investigate this anomaly.



Future Work: Results from the 2003 geophysical survey and past sampling events (surface water, sediment and fish tissue sampling) will be reviewed in order to determine if sufficient data exists to accurately evaluate the AOC. A Strategy Document is currently being developed to determine what future actions are necessary at the site. The strategy document is scheduled for submission in FY06.

A-8 Track A Magazine Line

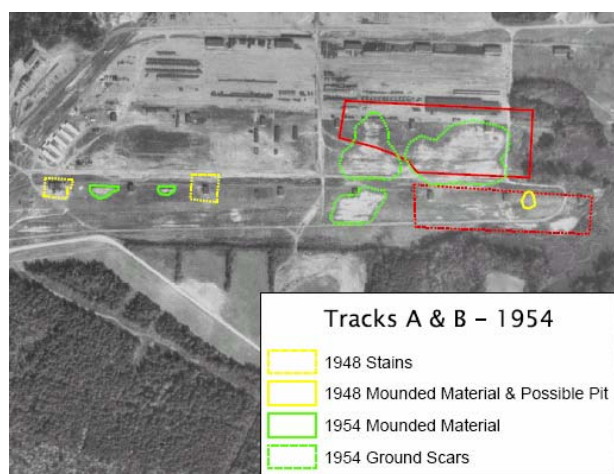
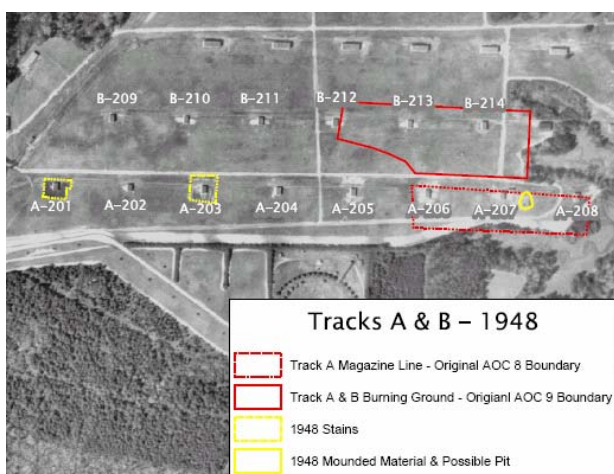
[POU-11]

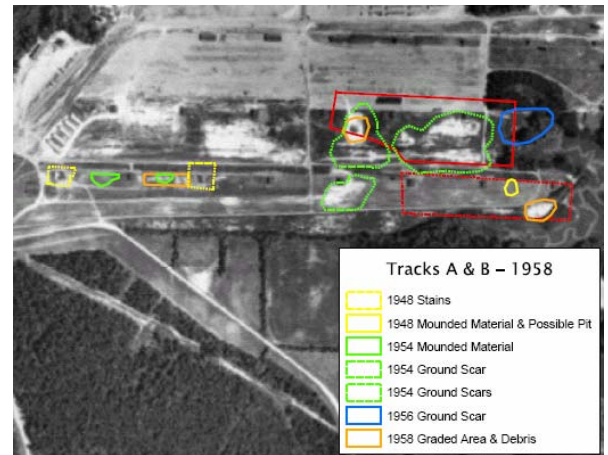
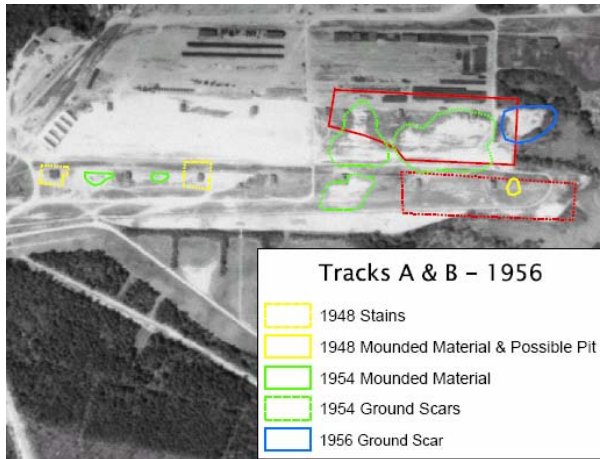
Size: The Track A Explosive Magazine Line is approximately 9.7 acres.

Location: The AOC is located between College Drive and Streeter Creek.

History and Past Work: Track A consisted of eight explosive magazines oriented east/west in a line, numbered A-201 through A-208 (from west to east). In 1948, stains were identified around buildings A-201 and A-203 and mounded material and a possible pit were located between buildings A-207 and A-208. In 1954, additional mounded material was observed between the westernmost buildings and a ground scar was just south of A-205. By 1958, light-toned material and debris were located between the westernmost buildings and a graded area with debris was located south of A-208. (*General Map dated January 1937*, ARF 05-02-023 and *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003)

- The 1997 geophysical survey resulted in no MEC related items being found. (EE/CA, ARF 01-04-007-F)





Future Work: AOC 8 will be investigated further in conjunction with AOC 9 (Track A & B Burning Ground). It is anticipated that a Site Investigation will be conducted in FY06. The Site Investigation Results will be evaluated in accordance with the SSP for FNOD.

A-9 Track A & B Burning Ground

[POU-11]

Size: The Track A & B Burning Ground is approximately 7.7 acres.

Location: The AOC is located between Interstate 664 and Streeter Creek near the Armistead Road overpass.

History and Past Work: Track A and Track B consisted of explosive magazines oriented east/west in two lines. In 1954, two large ground scars were identified between Tracks A and B. In 1956, a ground scar was observed east of B-214. By 1958, debris was located between the two magazine lines. (*General Map dated January 1937*, ARF 05-02-023 and *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003)

- During February of 1997, Weston, for EPA Region III, collected one soil sample from this area. The results indicated trace levels of SVOCs in the sample (*Final HRS Package*, ARF 01-13-031)
- The 1997 geophysical survey resulted in no MEC related items being found. (*EE/CA*, ARF 01-04-007-F)

Future Work: AOC 9 will be further investigated in conjunction with AOC 8 (Track A Magazine Line). It is anticipated that an SI will begin in FY06. The SI results will be evaluated in accordance with the SSP for FNOD.

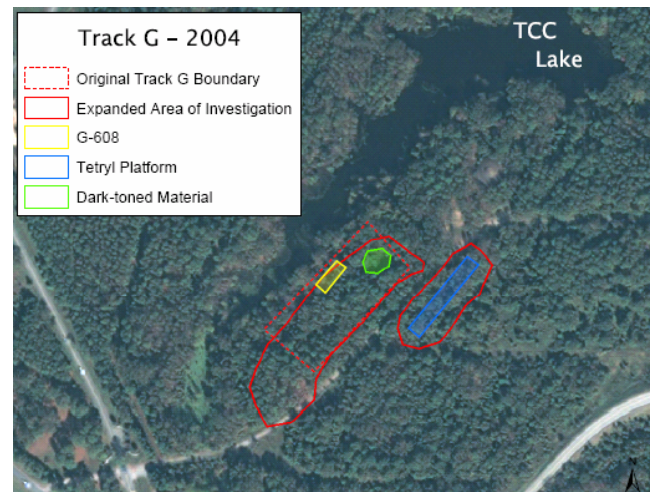
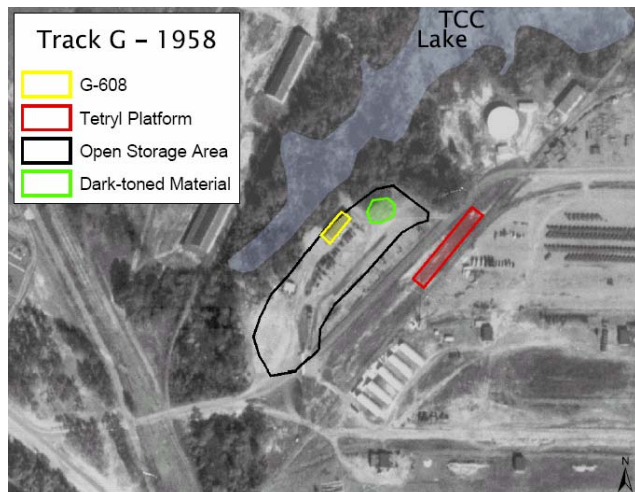
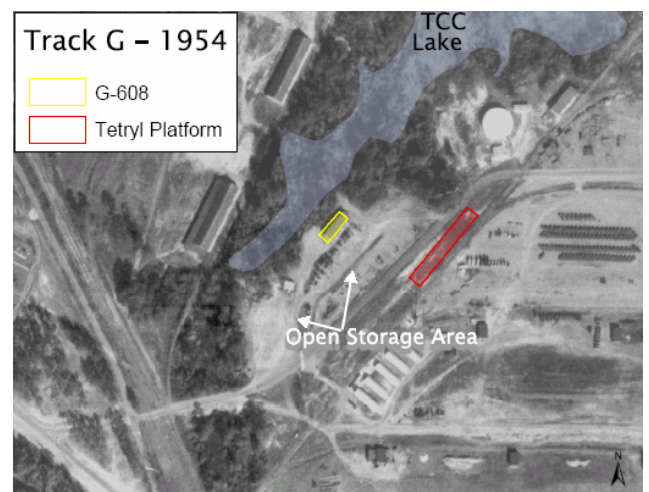
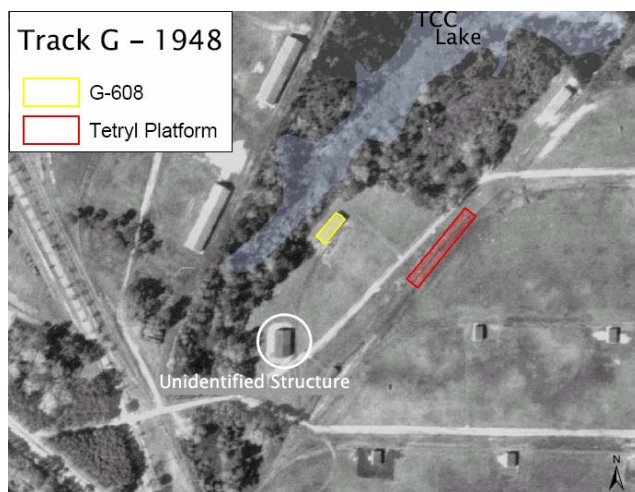
A-10 Track G Magazine Line

[POU-9]

Size: Unknown.

Location: The AOC consists of one structure, G-608, located along the southeast edge of TCC Lake.

History and Past Work: G-608 was a Primer & Fuse Magazine. The General Map, revised in 1937, shows the existence of a tetryl platform east of G-608. A tetryl platform is a loading platform for rail cars where tracks are lower than grade. In 1948, an unidentified structure was located southwest of G-608. In 1954, an open storage area was visible in the vicinity of G-608. And, in 1958, an unidentified dark-toned material was observed northeast of G-608. This AOC has not been investigated.



(General Map dated January 1937, ARF 05-02-023, Historical Photo Analysis, ARF 05-01-005, and Site Analysis Volumes 1 & 2, ARF 01-01-003 & ARF 05-01-003)

- A Work Plan for the field investigation, to include soil and groundwater sampling, was submitted in April 2005. The field investigation for AOC 10 will be conducted in conjunction with the field investigation for Tracks H and I (AOC 11). This Work Plan is currently being revised to include additional sample locations and analyses. Field work is anticipated to be completed in early FY 06.

Future Work: The SI results will be evaluated in accordance with the SSP, and a draft SSP Report is anticipated in FY06. Further action at the site will be determined based on the results of the SSP Report.

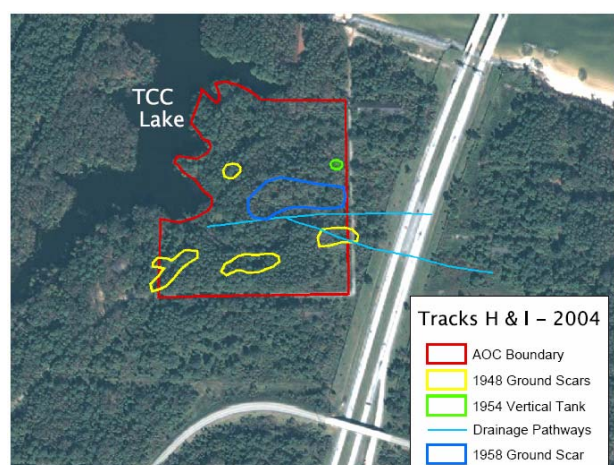
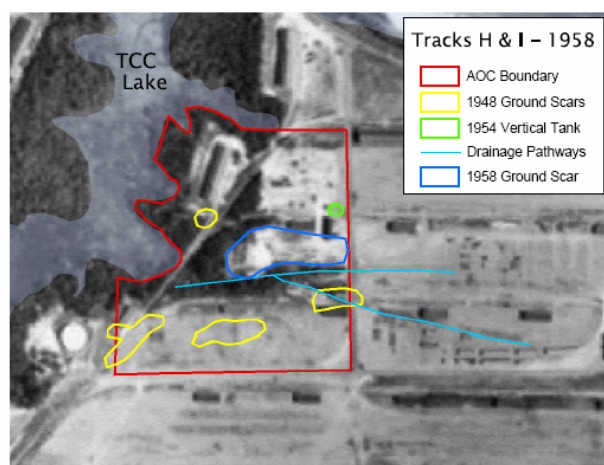
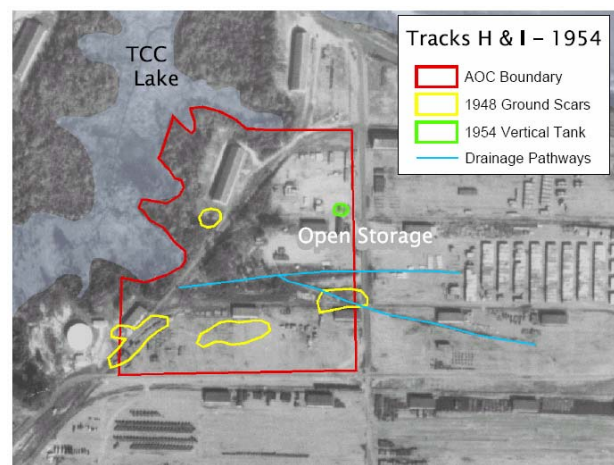
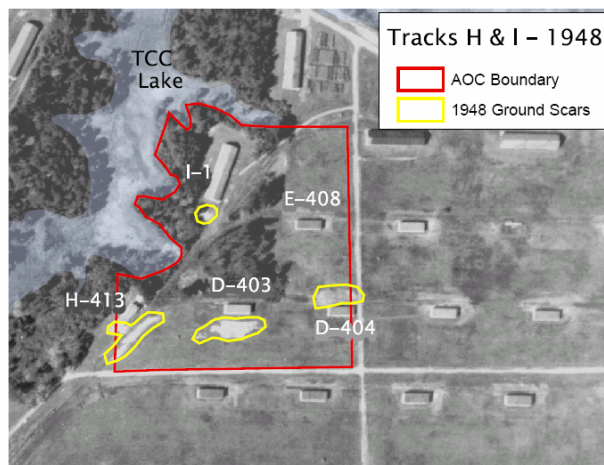
A-11 Track H and I Magazine Line (Scars)

[POU-9]

Size: Unknown.

Location: This AOC is the rectangular area east of TCC Lake, which includes buildings I-1, H-413, D-403, D-404, and E-408.

History and Past Work: I-1 was an Ammunition Magazine, and H-413, D-403, D-404, and E-409 were Smokeless Powder Magazines. In 1948, ground scars were located southeast of H-413, south of D-403, north of D-404, and south of I-1. In 1954, open storage areas and a vertical tank of unknown use, northeast of E-408, were observed. In 1958, a large ground scar was located south of E-408. In addition, drainage pathways existed across the open storage area, from east to west, across the AOC and emptying into TCC Lake.



(*General Map dated January 1937, ARF 05-02-023 and Site Analysis Volumes 1 & 2, ARF 01-01-003 & ARF 05-01-003*) This AOC has not been investigated.

- A Work Plan for the field investigation, to include soil and groundwater sampling, was submitted in April 2005. The field investigation for AOC 11 will be conducted in conjunction with the field investigation for Tracks G (AOC 10). This Work Plan is currently being revised to include additional sample locations and analyses. Field work is anticipated to be completed in early FY 06.

Future Work: The SI results will be evaluated in accordance with the SSP, and a draft SSP Report is anticipated in early FY06. Further action at the site will be determined based on the results of the SSP.

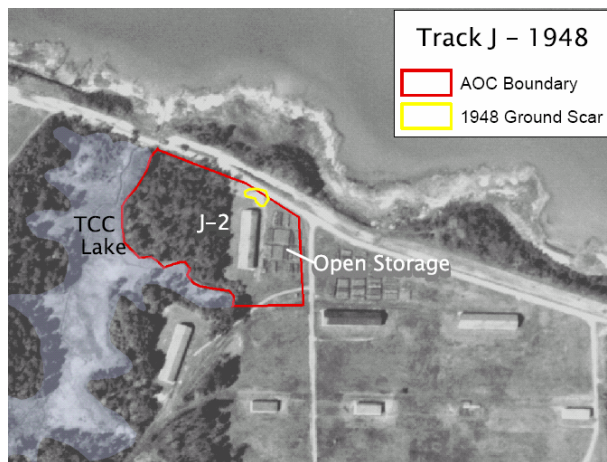
A-12 Track J Magazine Line (Scars)

[POU-11]

Size: Unknown.

Location: The AOC consists of one structure, J-2, located along the northeast edge of TCC Lake.

History and Past Work: J-2 was an Ammunition Magazine. In 1948, a materials storage area was located immediately east of the building and a possible ground scar was located north of the building.



(General Map dated January 1937, ARF 05-02-023 and Site Analysis Volumes 1 & 2, ARF 01-01-003 & ARF 05-01-003) This AOC has not been investigated.

Future Work: A Site Investigation is tentatively anticipated for the site in late FY 06. The focus of an anticipated SI will be the ground scar immediately north of J-2. The SI results will be evaluated in accordance with the SSP, and will be used to determine if further action is necessary at the site.

AOC-13 Abandoned Structures (Former Wastewater Treatment Plant)

[POU-10]

Size: The AOC is approximately 1/3 of an acre.

Location: The former Wastewater Treatment Plant (WWTP) AOC is located southeast of the NRB. The AOC includes a tower and three abandoned structures. (*Meeting Minutes dated 16 August 2001*, ARF 10-01-001)

History and Past Work: In 1948, a pit was observed at the future location of the WWTP. By 1954, the pit was no longer visible as the WWTP was constructed over it. (*Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003)

A field investigation, which included surface soil, subsurface soil, groundwater, and surface water, was completed in FY05. A Draft SSP Report was submitted to USACE in FY 2005 and comments are currently being incorporated.

Future Work: The Final SSP Report is anticipated for FY 2006. The results of the SSP Report will be used to determine if further action is necessary at the site.

A-14 Track K Magazine Line

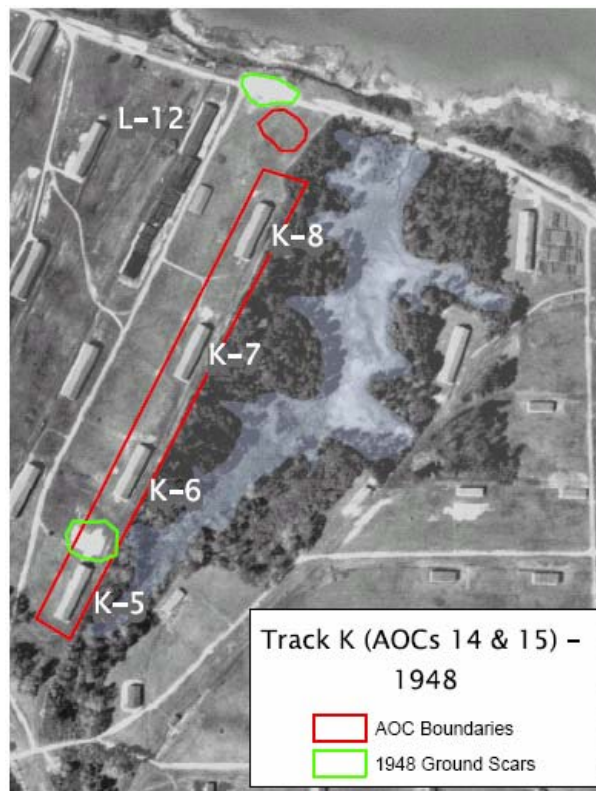
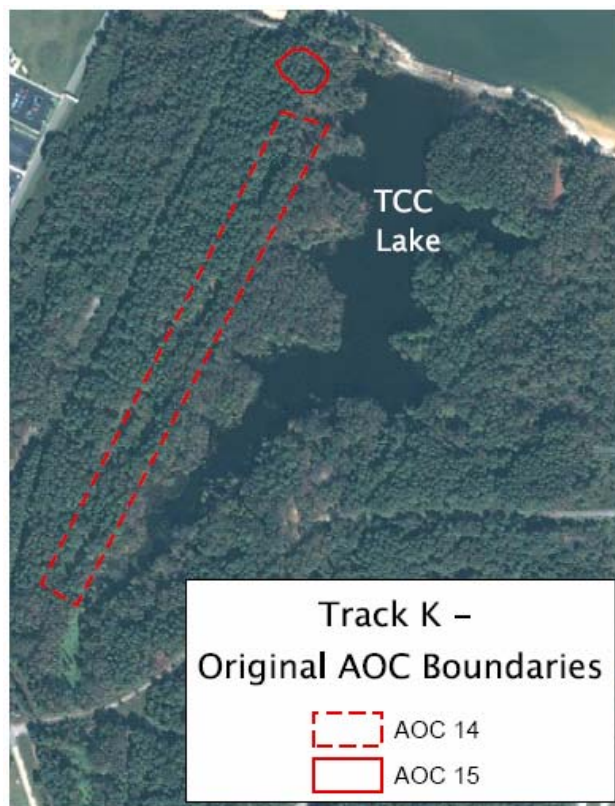
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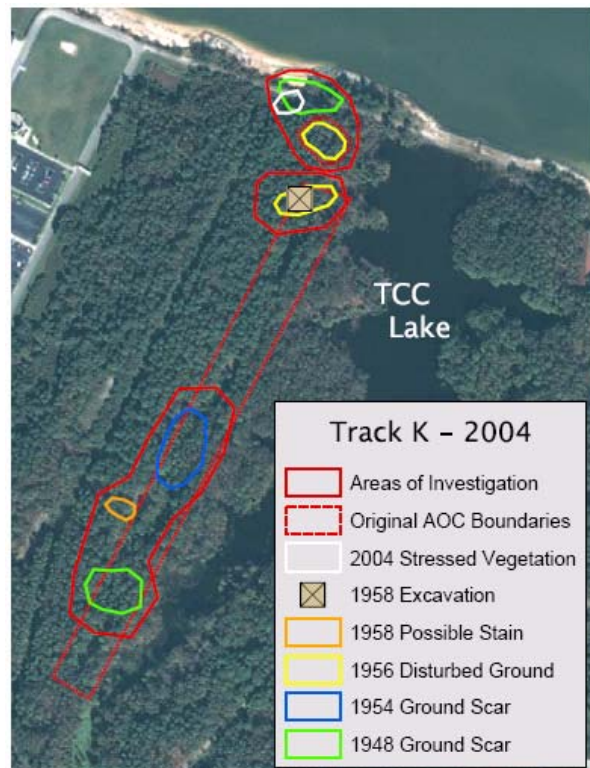
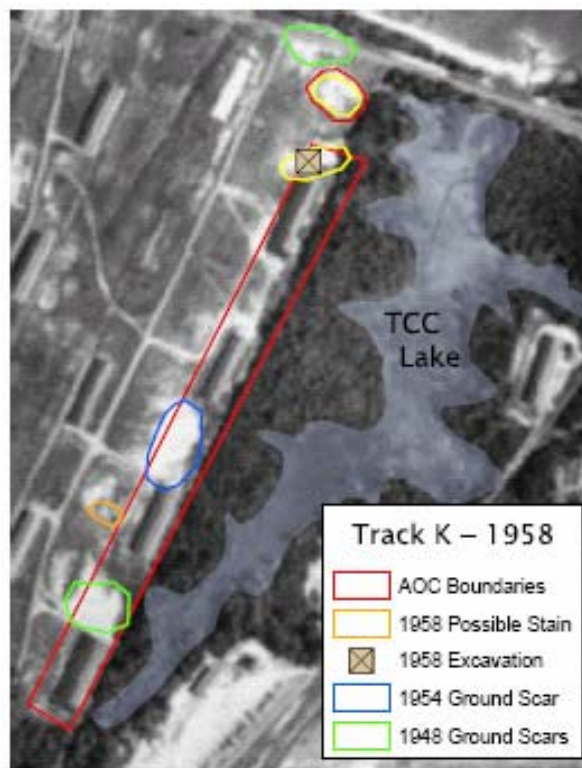
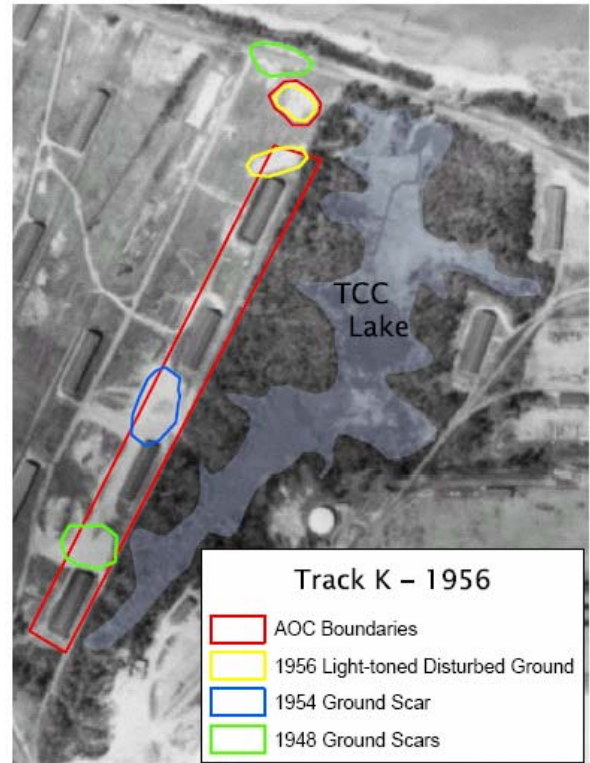
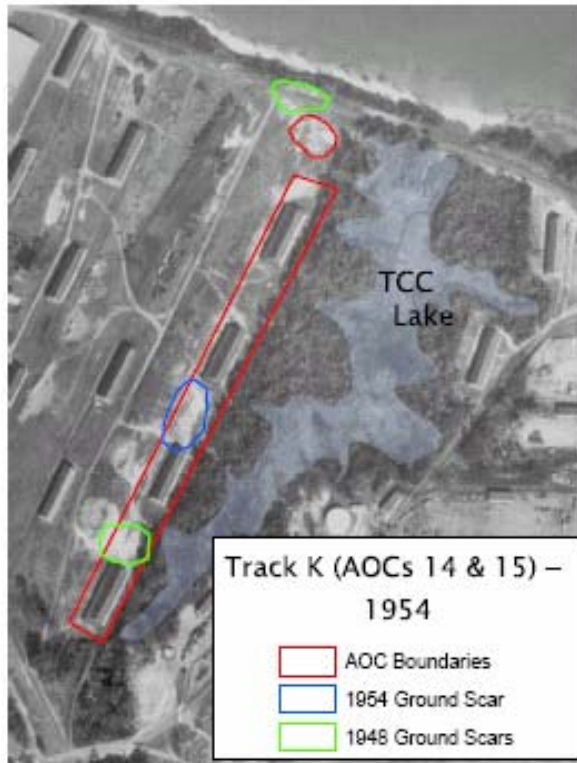
Size: Unknown.

Location: The AOC is located on the west side of TCC Lake.

History and Past Work: Track K consisted of four Ammunition Magazines oriented north/south in a line, numbered K-5 through K-8. In 1948, a ground scar existed immediately north of K-5. In 1954, a ground scar was located north of K-6. In 1956 two areas of light-toned, disturbed ground were observed north of K-8. In 1958, a possible stain was observed just west of K-6, and an excavation was located immediately north of K-8. In 2002, an area of stressed vegetation was discovered north of K-8.

The Track K Dump (SA-6), which partially within the AOC-14 boundary, is being investigated as a separate area.





(*General Map dated January 1937*, ARF 05-02-023 and *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003, *Historical Photo Analysis*, ARF 05-01-005)

- The 1997 geophysical survey near K-8 and north of K-8 resulted in no MEC related items being found. (*EE/CA*, ARF 01-04-007-F)
- A Scope of Work has been developed to perform a Site Investigation (SI) at Track K, in accordance with the SSP for FNOD. The field investigation for this project is anticipated for completion in FY06. The focus of SI will be the ground scars located north of K-5, north of K-6, and north of K-8. AOC 15 (the possible landfill and area of stressed vegetation) will also be investigated in conjunction with AOC 14.

Future Work: A The SI results will be evaluated in accordance with the SSP. The results of the SSP Report will be used to determine if further action is required at the site.

A-15 Track K Magazine Line Landfill

[POU-9]

Size: Unknown.

Location: The AOC is located in the vicinity of former Magazine K-8.

History and Past Work: In 1948, a ground scar existed immediately northeast of a structure identified as Platform L-12. L-12 was located approximately 400 feet northwest of K-8. In 1956 two areas of light-toned, disturbed ground were observed north of K-8. In 1958, an excavation was located immediately north of K-8. An area of stressed vegetation can be seen on aerial photos through the 1970's. (*General Map dated January 1937*, ARF 05-02-023 and *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003, *Historical Photo Analysis*, ARF 05-01-005)

- The 1997 geophysical survey near K-8 and north of K-8 resulted in no MEC related items being found. (*EE/CA*, ARF 01-04-007-F)
- A Scope of Work has been developed to perform a Site Investigation (SI) at the Track K Landfill, in accordance with the SSP for FNOD. The field investigation for this project is anticipated for completion in FY06. AOC 15 will be investigated in conjunction with AOC 14 and evaluated to determine if a landfill, possibly containing building debris from platform L-12, is present.

Future Work: The SI results will be evaluated in accordance with the SSP. The results of the SSP Report will be used to determine if further action is required at the site

A-16 Former Steam Heating Plant

[POU-11]

Size: The Steam Heating Plant AOC is approximately 13,000 square feet.

Location: The Steam Plant was located between College Drive and Wellner (formerly Park) Drive at the southern end of Track R.

History and Past Work: The Steam Plant was used by FNOD and, most recently, TCC.

- In June 1991, a Site Survey Summary identified the presence of three abandoned Underground Storage Tanks (USTs) at the Steam Plant. Each tank had a 25,000-gallon capacity and the tanks, in addition to the piping and related equipment, still contained free product. (*Inventory Project Report*, ARF 01-03-006)
- TCC removed the Steam Heating Plant in 1993.
- During December 1994, the USTs and appurtenances were removed. Analysis of soil beneath the USTs indicated that a petroleum release occurred and resulted in the over-excavation and removal of 100 cubic yards of contaminated soil. Confirmatory soil sampling in the bottom of the excavation revealed decreasing concentrations of contamination at seven of the eight locations. The one location originally having a TRPH concentration below the VDEQ reporting limit (74 mg/kg) had a concentration of 130 mg/kg after over-excavation. VDEQ concurred that no further action was required at the UST Site (*Closure Report*, ARF 01-13-092)
- A Technical Memorandum documenting that the AOC requires No Further Action was submitted in September 2005

Future Work: The No Further Action memorandum is pending regulatory concurrence. It is anticipated that a consensus document will be signed in early FY06 documenting No Further Action at the site.

A-17 PCB Transformer Removal

[POU-10]

Size: Unknown.

Location: Unknown.

History and Past Work: FNOD-era utility poles may be present at some remote locations. Based on the time of operation, transformers on those poles may contain PCB-contaminated oil.

Future Work: It is anticipated that an SI will begin in FY07. The SI results will be evaluated in accordance with the SSP and used to determine if further action is necessary at the site.

A-18 Suspected Underground Storage Tank and Tunnel

[POU-10]

Size: Unknown.

Location: An underground storage tank and tunnel was suspected to exist parallel to the former Track Q line of Magazines, in the northwest portion of FNOD (currently the TCC Truck Driver Training School).

History and Past Work:

- A suspected tunnel was identified during the 1999 geophysical investigation in the Truck Driver Training School area. In April 2000, TechLaw, for EPA Region III, investigated the structure. They determined that it was a reinforced concrete support foundation approximately 75 feet long x 12 feet wide x 8 feet deep. (*Trip Report*, ARF 01-02-010)
- A finding of No Further Action was issued on 23 February 2004 for the Suspect Underground Tunnel. (*Consensus Statement*, ARF 04-01-12.1)

Future Work: None Required

A-19 TCE Contamination Adjacent to the James River Beachfront

Size: Unknown.

Location: Immediately south of the JRB Source Area.

History and Past Work: The JRB was a general disposal site used by the Army during FNOD operations. It is categorized as a SA based on the evidence of MEC, MUNITIONS DEBRIS and contaminated soil discovered at the site. During the 1998 JRB Site Investigation, monitoring wells were installed, two of which were placed in locations believed to be upgradient background.

- During the 1998 SI, TCE was detected in groundwater collected from the background wells at concentrations exceeding regulatory limits. (*Final SI*, ARF 01-13-027 F)
- During the 1999 EE/CA evaluation, TCE was detected in groundwater collected from one background well at a concentration exceeding regulatory limits. (*EE/CA*, ARF 01-04-012 F)
- In July 2002, a MW was installed south of the existing JRB background wells. Soil collected from the MW boring was analyzed, but no TCE was detected. (*Draft Summary of Groundwater Investigations*, ARF 01-13-109 v1)
- In October 2002, groundwater from the new MW was tested; however, no TCE was detected. (*Draft Summary of Groundwater Investigations*, ARF 01-13-109 v1)
- In January 2003, groundwater samples were collected from the two JRB wells and two of the JRB background wells. No TCE was detected (Method Detection Limit – 1 ug/L). (*Draft Summary of Groundwater Investigations*, ARF 01-13-109 v1)
- In June 2003, groundwater samples were collected from the two JRB wells and two of the JRB background wells. No TCE was detected (MDL – 1 ug/L). (*Draft Summary of Groundwater Investigations*, ARF 01-13-109 v1)
- The final quarterly groundwater samples were collected in December 2003 and no TCE was detected (MDL – 1 ug/L). (*Draft Summary of Groundwater Investigations*, ARF 01-13-109 v1)
- The quarterly groundwater sample results were validated in FY05.
- A Consensus Letter documenting that no further action is required at the AOC was issued in FY05.
- All groundwater sampling results were provided to Weston for use in the JRB Remedial Investigation Report.

Future Work: The results of the TCE investigations will be incorporated into the JRB Remedial Investigation Report, which is tentatively scheduled for completion by the end of FY06.

A-20 Abandoned Water Treatment Plant

[POU-10]

Size: The Abandoned Water Treatment Plant (WTP) facility covers approximately ½ an acre.

Location: The AOC is between the southeast shore of TCC Lake and Club Drive, west of Smokeless Powder Magazine H-413.

History and Past Work: The Abandoned WTP was part of the water supply system for FNOD. The system included three water storage tanks, ten wells, a treatment plant and pumping stations. The system was designed such that the two smaller, elevated water tanks supplied the western half of the depot, and the Abandoned WTP supplied the eastern section. The Abandoned WTP included a million gallon, 95-foot diameter, aboveground water storage tank. Two buildings were located immediately south and northeast of the tank, one of which was a pump house. The abandoned water tank is still standing. One diesel pump was used in the system, but the location of the diesel pump is unclear. (*Master Shore Station Development Plan*, ARF 05-02-015; *Site Analysis Volumes 1 & 2*, ARF 01-01-003 & ARF 05-01-003)

- A February 2000 site visit, conducted in conjunction with the Desktop Audit for TCC Lake, revealed the existence of a possible UST adjacent to the pump house. (*Desktop Audit, March 2002*, 01-13-057 F)
- A Technical Memorandum for the Record was completed in October 2004, which documented the need for further investigation of the suspected UST.

Future Work: A Site Investigation of the suspected UST at the Former WTP is tentatively scheduled for completion in FY06, in accordance with the SSP for FNOD. The results of the SSP Report will be used to determine if further action is necessary at the site.

A-21 Officers' Pool Chlorine Containers

[POU-9]

Size: This AOC is limited to the disinfection facilities at the pool.

Location: The Officer's Pool was located in the center of the depot between Tracks P and Q, southeast of the former Renovation Plant.

History and Past Work: The pool was used subsequent to DOD control of FNOD, and it is unknown when it was removed from service. Swimming pool chemicals (chlorine containers) were added to the AOC list in 2001 due to concerns about the potentially hazardous containers. (*Meeting Minutes dated 16 August 2001*, ARF 10-01-001)

- On 3 June 2003, the TCC Facilities Maintenance Department removed the swimming pool chemicals and shipped them to the Chemtron Corporation in Avon, Ohio for disposal. (*Letter dated 31 July 2003*, ARF 04-01-11.1)
- A finding of No Further Action was issued on 23 February 2004 for the Officer's Pool Chlorine Containers. (*Consensus Statement*, ARF 04-01-12.1)

Future Work: None required.

A-22 Arsenic Investigation

[POU-8 NRB]

Size: Unknown

Location: AOC 22 is located between the Horseshoe Pond and General Electric.

History and Past Work: On the 1952 aerial photograph, a channel can be observed extending from the northernmost leg of the Horseshoe Pond northeast. General Electric operated a rail line, which ran parallel to the southern side of the facility.

- In June of 1999, groundwater were collected from General Electric Monitoring Well 18A, located between the southwest corner of the GE building and the Nansemond River. Dissolved arsenic was detected at a concentration of 7 µg/L in this sample.
- In March 2002, groundwater was collected from GE MW 18A, and dissolved arsenic was detected at a concentration of 26 µg/L.
- During October 2004, an investigation was conducted in the vicinity of the Horseshoe Pond to determine the extent of dissolved arsenic in the groundwater. Ten (10) temporary wells were installed. Groundwater was collected from the ten temporary wells as well as five (5) monitoring wells located in the general vicinity. Dissolved arsenic was detected in groundwater collected from two wells located closest to the GE Plant building (at concentrations of 4.9 and 8.8 µg/L, respectively).
- Based on the locations of the arsenic detections in groundwater and the general direction of groundwater flow, it does not appear that the arsenic detections are attributable to the HSP. However, further investigation will be conducted in the area northeast of HSP and in the vicinity of the GE Building.
- A Consensus Statement was signed on August 4, 2005 establishing AOC 22 as a new Area of Concern at FNOD. The Consensus Statement indicates that an investigation is necessary to determine the presence of any source areas and the nature and extent of any contamination in the area.
- A Scope of Work (SOW) has been developed to further investigate the presence of arsenic AOC 22. One possible reason for the presence of elevated arsenic in groundwater that will be investigated in detail is that the arsenic concentrations are naturally occurring and due to the unique geochemistry of the area.

Future Work

A Work Plan for the AOC 22 Site Investigation will be submitted in early FY 2006. Upon review and approval of the Work Plan, the Site Investigation will also be conducted in FY 2006.

A-23 Renovation Plant

Size: Unknown

Location: The Renovation Plant AOC is located north of the General Electric Building on TCC Property. Currently, the AOC is used for a Truck Driver Training School.

History and Past Work: During DoD occupation, the Renovation Plant was used to renovate shells. In 1948, a pit was observed north of the building. In 1954, a stain and possible pit were observed northeast of the building. All that remains of the Renovation plant is some tile flooring (*Site Analysis, Volume II*, ARF 05-01-003).

- During an April 2000 geophysical investigation, UXB discovered a subsurface concrete structure adjacent to Building Q-28. (*Trip Report*, ARF C03VA004513 02.19 0001)
- In April 2000, TechLaw, for EPA Region III, investigated the structure. They determined that it was a reinforced concrete support foundation approximately 75 feet long x 12 feet wide x 8 feet deep. (*Trip Report*, ARF C03VA004513 02.19 0001). A finding of No Further Action was issued in February 2004 for the suspect underground tunnel. (*Consensus Statement*, ARF 04-01-12.1)
- A Consensus Statement was signed on August 4, 2005 establishing AOC 23 as a new Area of Concern at FNOD.
- A Site investigation is planned for FY 2006 to investigate potential contamination from the features (i.e. pit, stains) observed on the historical aerial photographs of the site. A Draft Work Plan was submitted to USACE in August 2005 for the field investigation of the Renovation plant Area, and comments are being incorporated.

Future Work: A Draft SSP Report is scheduled to be submitted in early 2006. The results of the SSP Report will be used to determine if further action is necessary at the site.

8 Other Relevant Investigations and Activities

Land Use Control Implementation Plan

Land Use Controls (LUCs) include physical, legal or administrative mechanisms that restrict the use of, or limit access to, property at FNOD. LUCs are being implemented at known or suspected MEC sites to protect human health and the environment where risk is known, suspected, or cannot be totally eliminated. LUCs were an integral part of the 1998 Final EE/CA, the May 1999 Action Memorandum for non-time-critical MEC removal actions, the May 1999 Technical Memorandum signed by the Army and the EPA, and the December 1999 Interagency Agreement (IAG) to Perform a Time Critical Removal Action for Ordnance and Explosive Safety Hazards.

Work developing the appropriate LUCs for FNOD began in mid-2000. A LUC Work Group meeting and RAB presentation were conducted in December 2001. Public comment on the LUCs was solicited and taken into consideration while drafting the final LUC Implementation Plan. During 2001, a Land Use Control Assurance Plan, Land use Control Options Paper, Risk Management Strategy Report, and Interim Land Use Control Implementation Plan (LUCIP) were developed. The Final Interim LUCIP was issued in August 2002. (*Interim LUC Implementation Plan*, ARF 02-05-003 F)

A memorandum of Agreement with The Virginia Community College System / Tidewater Community College was signed on 2 February 2005, and a final exchange of letters between the Corps of Engineers and the City of Suffolk agreeing to support land use controls occurred in August 2005. The FNOD Project Delivery Partnering Team (to include EPA and Virginia DEQ) agreed on 4 August 2005 that the above actions constituted material completion of the land use requirements of the TCRA IAG.

The remaining Munitions Response activities at FNOD are being conducted as a Non-Time Critical Removal Action (Non-TCRA). At the completion of the Non-TCRA, the CoE plans to draft an Abbreviated RI/FS to determine if any additional Remedial Response is needed. A Proposed Plan and Record of Decision (ROD) will be used to select the final Remedy. Following DOD/EPA guidance, if Institutional Controls constitute, or are included in the selected Remedy, a Final Land Use Control Implementation Plan will be part of the resulting Remedial Action

Time Critical Removal Action

In May 1999, the Norfolk District and EPA Region III entered into an Interagency Agreement to perform a Time Critical Removal Action (TCRA) at five locations on TCC property. The purpose of the TCRA was to locate potential HTRW disposal areas and single MEC items possibly existing in areas not fully investigated under the Final EE/CA issued in October 1998. (IAG, ARF 01-08-005). The geophysical survey areas, and the reasons for their investigation, are listed below:

- 1) TNT Source Area – The area beyond the boundary of previous HTRW and MEC investigations was investigated in order to determine if other disposal activities occurred in the vicinity of the TNT SA.
- 2) Athletic Fields (North & South) – Based on the terrain of these areas, they were included in the survey.
- 3) Renovation Plant Area - This area was used to renovate shells.
- 4) Buildings L-11 and L-12. - These magazines were destroyed by fire.
- 5) Building E-410 - This magazine was destroyed by fire.

The geophysical survey was started in July of 1999 with the TNT SA, North and South Athletic Fields, and Renovation Plant. Buildings L-11, L-12, and E-410 were surveyed at a later date. Final coordinates of potential disposal areas (pits and trenches) and single point magnetic anomalies were recorded and the locations were flagged for further investigation. (*Final Field Report*, ARF 01-01-048 & *Final Report MEC Removal Action*, ARF 01-13-094)

Physical Removal Actions began in March of 2000 and were completed on 9 July 2003. Unfortunately, a number of dig sheet records could not be located. Lacking the results of those investigations, certain anomalies had to be re-acquired and re-investigated to ensure that all previously located items of concern were removed. That effort was completed on 24 June 2004.

One of the activities stipulated in section 12.2 of the IAG was to provide for post removal site control. Although a Land Use Control Implementation Plan was signed on 21 August 2002, the key agreements with the City of Suffolk and the major land owner, Virginia Community College System / Tidewater Community College, were not in place until August 2005. The memorandum of Agreement with The Virginia Community College System / Tidewater Community College was signed on 2 February 2005, and a final exchange of letters between the Corps of Engineers and the City of Suffolk agreeing to support land use controls occurred in August 2005. The FNOD Project Delivery Partnering Team (to include EPA and Virginia DEQ) agreed on 4 August 2005 that the above actions constituted material completion of the land use requirements of the TCRA IAG.

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Background Sampling Program

Weston, for USACE Baltimore District, conducted a Background Sampling Program in order to determine background concentrations of selected constituents in soil and groundwater. The results of the Background Sampling Report will be used in the risk assessment process to

determine if analytical results acquired during investigations at AOCs are sufficiently different from background levels. The Background Sampling Program field activities (soil and groundwater sampling) were completed in two phases, beginning in November of 1999. Results of the 1st phase were reported in a November 2000 draft report, which recommended additional sampling in order to increase the level of precision and confidence in the original report. This second phase of sampling was completed in January 2002. Both soil and groundwater were evaluated for Metals, Volatile Organic Compound (VOC), Semivolatile Organic Compounds (SVOCs), Pesticides, PCBs, Explosives, Lead, Cyanide, Mercury, and Dioxins and the validated results are included in the Draft Final Background Sampling Program Report issued in August 2002. The Final Report was issued during FY04 and includes a 95% Upper Tolerance Limit table for detected compounds in soil and groundwater.

Pesticide Drum Area

The Pesticide Drum Area is listed under Other Areas of Investigation (OAOI) as Site O-7. OAOIs are areas that may or may not be added to the list of AOCs based on the results of preliminary evaluations. In 1998, two unsealed, unmarked 55-gallons drums, one empty and one containing an unknown liquid, were found on TCC property in a wooded area bounded by Interstate 664, College Drive, and Armistead Avenue. In November of 1998, two surface soil samples were analyzed, and the suspect liquid was analyzed in May of 1999. Based on the soil and liquid analytical results, the SSP was initiated at the Pesticide Drum Area in early 2000. The drums were removed in November 2000 and screening level soil samples were collected. Based on those sampling results, four additional locations were sampled (surface and subsurface) in February 2002. The validated results were compared to the SSP criteria, including background levels, and indicate that Dieldrin is a CoC. (Draft SSP, ARF 01-13-105)

During FY04, delineation soil sampling was conducted in order to determine the extent and levels of contamination present. It was previously determined that an Engineering Evaluation and Cost Analysis (EECA) would be necessary to select an appropriate remedial action at the site. However, it has since been determined and agreed upon by the PDT that a Remedial Investigation Report will be prepared for the Pesticide Drum Area. The RI Report, which is tentatively scheduled to be completed in FY06, will be used to determine if remediation will be required for the site.

Hydrologic Conceptual Site Model

The hydrologic CSM is being developed to analyze the FNOD hydrologic system by investigating water flow in terms of mass balance and ground- and surface water budgets throughout the investigational area. A properly calibrated CSM is a numerical model that simulates groundwater flow, providing investigators a means to predict the fate and transport of groundwater contaminants. The hydrologic CSM has already contributed significantly to groundwater investigations for the overall FNOD site and will support future investigations of individual Source Areas and AOCs.

Data required for the CSM include seasonal groundwater and surface water elevations, soil and groundwater contaminant concentrations from recent and past investigations, and lithology from soil and monitoring well borings. In addition to site-wide monitoring wells, one off-site deep and shallow well cluster was installed in the Respass Beach Community. Staff gauges were installed in the Nansemond & James Rivers and Streeter Creek (2 at each location) and at TCC Lake, J Lake, Horseshoe Pond, GE Pond, and Dominion Pond (1 at each location). The eleven staff gauges will be used to evaluate surface water interaction within the overall local hydrologic system. The CSM identified several problem monitoring wells that were producing faulty data. Subsequent study of well construction and field visits uncovered problems, such as structural failure and clogged well screens, thus allowing investigators to purge the faulty data from the CSM database.

Hydrologic analysis is being conducted using MODFLOW-based software programs, primarily Groundwater Vistas and MODFLOW-SURFACT. The output files of these programs require only minor file adjustments to be compatible with the DOD's Groundwater Modeling System (GMS) software. A preliminary review of existing information indicates:

- The dominant steady-state shallow aquifer flow direction over the majority of the FNOD area is north, towards the James River. In the northwest corner, transient flow is probably more to the north-northwest during wet periods and during low tides, acknowledging the presence of the Nansemond River, but the CSM indicates that the effect of the Nansemond appears to be considerably less than previously believed. Thus, flow from the Dominion Lands area is predominantly due north, through the GE property and towards the James River. To the south, the flow is more to the northeast but also towards the James River. At the southeast corner of the site, groundwater flows towards Streeter Creek which itself flows into the James River.
- Groundwater flow in the center of the site (Dominion Lands area) is more complex with some local mounding contributing to seasonal flow direction; however, the overall northerly flow component dominates over time. Particle tracking analysis has provided investigators with a much better understanding of local flow in this area.
- Groundwater flow into TCC Lake is best characterized as seasonal. During wetter periods, groundwater flows into the lake and, as water level within the lake increases, TCC Lake acts as a discharge source into the surface aquifer. Therefore, TCC Lake may act as a source of contamination when water levels are high and the lake is discharging to the aquifer. However, during the summer months, flow is reversed and the underlying aquifer discharges into TCC Lake. In any case, the dominant groundwater flow direction continues to be northerly, minimizing the chances of any potential contamination being carried from TCC Lake towards residential communities to the east, southeast and south.
- On the east side of FNOD, the CSM clearly demonstrates that Streeter Creek acts as a hydraulic divide preventing groundwater flow from FNOD from crossing Streeter Creek and reaching communities on the eastern side. Shallow groundwater flows from both the west and east into Streeter Creek, identifying this surface water body as a shallow aquifer discharge site. It appears that the flow in the underlying Yorktown Eastover (confined)

aquifer is also controlled by this hydraulic divide, suggesting that deep production wells to the east of Streeter Creek are not being impacted by FNOD. To date, broad-spectrum chemical analyses of shallow and deep wells on both sides of Streeter Creek appear to support the hydrologic interpretation being provided by the CSM.

The hydrologic CSM will undergo continuous refinement as new data (chemical analysis, elevations, permeability and lithology) are collected over time. The first iteration of the CSM will be issued during FY05. Subsequent versions of the CSM will be issued as additional information becomes available.

Residential Well Sampling

The Respass Beach neighborhood, located immediately east of the FNOD boundary and adjacent to Streeter Creek, obtains drinking and household-use water from private and community wells. Groundwater samples were collected from the Respass Beach residential wells on three occasions in order to evaluate the possibility of off-site migration of contaminants from FNOD. The latest sampling event occurred in April 2002. The neighborhood was divided into quadrants, and two residential wells (one shallow, one deep) were tested in each quadrant, for a total of eight wells tested. The analytical results were validated, and no FNOD-related contaminants were detected in the groundwater. However, MTBE (a fuel additive), Nitrates, Fluoride, and Sodium were above EPA Maximum Contaminant Levels. The owners of the tested residential wells were notified of the analytical results. The VDEQ Tidewater Regional Office initiated an investigation into the one location where MTBE was detected and offered the residents an alternate water source, which the residents declined. The detections of Sodium and Fluoride were within normal regional aquifer levels. The residential well in which Nitrates were detected had other localized water quality issues of which the owner was aware. (*Analytical Report*, ARF 01-13-113) The City of Suffolk plans to extend municipal water and sewer lines to the Respass Beach Community.

Two additional monitoring wells (shallow & deep) were installed in the Respass Beach neighborhood to support the hydrologic CSM.

9 Potential HTRW Dig Sheet Items

During MEC investigations, “dig sheets” are completed detailing the location of the excavation and the items recovered. Upon reviewing several dig sheets, EPA Region III notified the Norfolk District of their desire to have non-MEC items, which could be potential HTRW issues (i.e. burn layers, slag, crushed drums, USTs, trash pits, etc...), documented and independently investigated as part of the SSP for the AOC in which the item was discovered. (*Letter dated 2 March 2000, ARF 04-01-008*).

The Norfolk District Project Engineer is notified as potential HTRW is discovered during MEC investigations. The Project Engineer documents the location and description of the items found and schedules further investigation, including media sampling, as close to the time of discovery as practicable.

All completed dig sheets are reviewed for possible HTRW. Table 9.1 provides a summary of potential HTRW issues discovered during MEC investigations at FNOD.

Table 9-1 – Potential HTRW Issues

HTRW Issue	Location	Date Found	Investigation	Resolution
Tar-like substance	Pit 15 (soccer field adjacent to TNT SA)	February 2000	A layer of tar-like substance was discovered, along with construction debris, during an anomaly investigation. 5 composite soil samples were taken from the pit. The tar-like substance was placed in a 55-gallon drum.	TCC notified of debris (left in place) .
Tar-like substance	Pit 19 (soccer field adjacent to TNT SA)	February 2000	A Photoionization alarm sounded during an anomaly investigation. Construction debris and tar were discovered in pit. Three composite soil samples were collected from the pit.	
Burn Layer	MBG, Grid D-2	April 2001	A burn layer was discovered in a ditch leading from Steamout Pond, approximately 3 inches below the surface. Suspicious petroleum odors were noted.	Requires further investigation
Creosote	MBG, Grid E-3	December 2001	Suspect creosote mixed with construction debris was discovered during OE investigation. Material was tested for VOCs and SVOCs. VDEQ evaluated analytical results and supporting documentation, classified as solid waste.	Debris removed and disposed of in permitted sanitary landfill.
Asbestos Piping and Debris	MBG	November 2001	Asbestos-encased pipes were discovered during an MEC investigation. Material was sampled and tested positive for asbestos.	22 bags of asbestos waste (pipes, scrap metal and contaminated soil) were removed and transported to permitted landfill for disposal. Confirmatory soil sampling conducted. Backhoe bucket decontaminated. Excavation backfilled with non-contaminated soil
Cylinder	MBG, Grid D-9	January 2002	Reactivities Management investigated and identified it as a hydraulic accumulator (non-hazardous and non-OE).	Item disposed of with trash in January 2002.

HTRW Issue	Location	Date Found	Investigation	Resolution
Steam Table	MBG, Grid E-15	May 2002	Large sink (possible steam table) unearthed during an MEC investigation. A soil sample was collected and analyzed. Three compounds exceeded Industrial Soil RBCs.	Analytical results provided to OE Contractor for review by the Certified Industrial Hygienist and Weston for inclusion in the MBG RI Report.
Asbestos Debris	MBG, Grid D-15	April 2003	Asbestos debris was discovered during an OE investigation. Material was sampled and tested positive for asbestos.	
M1041 Gas Masks	MBG	December 2003	20 MI041 charcoal gas mask filter canisters unearthed. Filters analyzed for TCLP.	Filter media results negative. Filters disposed in municipal landfill.
75 mm Incendiary Round	NRB	April 2004	One 75mm incendiary round consisting of an outer casing containing lead oxide red (aka lead tetra oxide, CAS 1314-41-6). The lead oxide read must be disposed of as HTRW.	The round was detonated and the HTRW contents were packaged and removed to a certified HTRW waste disposal facility.
Crushed Drums	MBG, Grid E-3	February 2003	Crushed drums and discolored soil unearthed during MEC investigation. Drums removed, soil below drums sampled.	Drums discarded, soil left in place.
Underground Structure	Adjacent to the MBG, near MW 14	November 2004	An underground structure was discovered during clearing operations. No stained soils or suspicious odors observed.	Apparent drainage structure. Left in place.
Crushed Drum	TCC Grid TC-S-K4	November 2004	Remains of a crushed drum were discovered during a MEC investigation. No stained soil or suspicious odors observed.	Soil below the drum remains analyzed for explosives, SVOCs, metals, and cyanide. No HTRW issues discovered.
Asbestos Debris	GE MBG, Grids GE_D-013, GE_D-015	March - May 2005	Asbestos debris was discovered during MEC investigation activities. Material was sampled and tested positive for asbestos.	Material was packaged and appropriately disposed of during March and April 2005

10 Munitions & Explosives of Concern Response Activities

Munitions and Explosives of Concern response activities began in 1987 soon after the discovery of the crystalline TNT at TCC.

- The original MEC sites included the TCC Retention Pond (east of the Beazley building), the JRB, and the TNT Source Area; however, only MEC-scrap was found at the Retention Pond and JRB.
- USACE Huntsville District supervised a geophysical survey and anomaly investigation at several locations throughout FNOD where there was the possibility of MEC being present. (*Final EE/CA*, ARF 01-04-007-F)
- Although an Engineering Evaluation/Cost Analysis (EE/CA) for a Non-Time Critical Removal Action was completed for the whole of FNOD in October of 1998, the DOD and EPA entered into a Time Critical Removal Action (TCRA) Interagency Agreement (IAG) in lieu of an EPA enforcement action to accelerate work at FNOD. At that time a number of munitions actions had already taken place, to include geophysical investigation of those areas governed by the IAG. Physical Removal Actions began in March of 2000 and were completed on 9 July 2003. Unfortunately a number of dig sheet records were found to be missing. Lacking the results of those investigations, the anomalies had to be re-acquired and re-investigated. That effort was completed on 24 June 2004.

One of the activities stipulated in the IAG was to provide for post removal site control. Although a Land Use Control Implementation Plan was signed on 21 August 2002, the key agreements with the City of Suffolk and the major land owner, Virginia Community College System / Tide Water Community College, were not in place until August 2005. The memorandum of Agreement with The Virginia Community College System / Tide Water Community College was signed on 2 February 2005, and a final exchange of letters between the Corps of Engineers and the City of Suffolk agreeing to support land use controls occurred in August 2005. The FNOD Project Delivery Partnering Team (to include EPA and Virginia DEQ) agreed on 4 August 2005 that the above actions constituted the completion of the TCRA. The Draft TCRA Report was submitted to the EPA the first week in October 2005.

- Two suspect anomalies at the HSP were investigated and removed during the week of 20 June 2005. One was a length of pipe approximately 6 ft by 1 inch with some metal banding material, and the other was coil of wire and a length of pipe approximately 3 ft by 1 inch. In each case the orientation of the debris created a significant magnetic anomaly signature that could have been ordnance. No further Munitions investigation is planned for the Horse Shoe Pond Area.

- The Mechanical Sifter was placed in operation on 6 September 2005. Initial results indicated the Mechanical Sifter throughput could be as much as 2 to 4 times the manual throughput. However, without experience on reliability and weather impacts on the operation, the project timeline has not yet been changed.
- Ongoing MEC investigations are occurring in the MBG and north of Welner Drive on TCC property.
- An MEC investigation is scheduled for the NRB during FY06.
- USACE Huntsville District provides construction support, as needed, during HRTW field activities in locations where MEC presence is known or suspected.

MEC found to date is listed in Table 10-1, FNOD MEC Removal Summary.

Table10-1 - MEC Removal Summary

DATE	AREA	UXO ITEMS	DMM ITEMS	MISC MUNITIONS POUNDS	BULK EXPL POUNDS	MUNITIONS DEBRIS (MD) POUNDS	NON-MD SCRAP POUNDS	CONTAMINATED SOIL POUNDS
1975	TCC Shoreline		500		3,000			
1987	TNT Area		19	6,930	5,270		440	30,275
1992	TNT Area		2					190,000
1992	JRB		12					
1992	JRB		5					
1993	JRB		6					
1994-96	TCC Retention Pond					31,450		
1996-97	Main Burning Ground		6					
1996-97	Horse Shoe Pond		2					
1996-97	TDD Retention Pond		1					
1998	Impregnite Kit Area							1,720,000
1999-01	Pits and Trenches		408		1	157	1,956	
1999-01	Dominion Lands 1		127			110	2,296	
1999-01	Dominion Lands 2		66			586	2,700	
1999-01	L-11 / L-12 / E410		-				214,778	
1999-01	Main Burning Ground		194			13,808	135,826	
1999-01	JRB		-					
2001	Main Burning Ground		153			4,724	143,049	
2001	Pits and Trenches		454		0	6,175	18,328	
2001	TNT Area		14			171	319	
2002	Main Burning Ground		98			103,811	236,611	
2002	Dominion Lands 1/2		8			37	4,380	
2002	TNT Area		139	62	109	166	21,710	
2003	Main Burning Ground	-	13	-	-	283	217,916	-
2003	TNT Area	-	78	-	494	148	37,371	-
2003	JRB/NRB	-	1	-	-	153	-	-
2004	Main Burning Ground		95	-	-	566	136,667	
2004	TCC Ath.Flds & NRB		147	-	-	434	34,985	
2004	HSP		-	-	-	-	91	
2005	MBG		13	-	-	435	17,403	-
2005	TCC NRB/Welner Dr		11	-	-	121	122,729	-
2005	HSP		-	-	-	-	17	-
TO-DATE TOTALS		UXO ITEMS	DMM(OE) ITEMS	MISC MUNITIONS POUNDS	BULK EXPL POUNDS	MUNITIONS DEBRIS (MD) POUNDS	NON-MD (OE) SCRAP POUNDS	CONTAMINATED SOIL POUNDS
		-	2,572	6,992	8,874	163,334	1,349,572	1,940,275

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ARF 01-12-002 F	Final Remediation Report; <i>Earth Tech, January 2003.</i>

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ARF 05-02-023	Nansemond Ordnance Depot General Map; <i>Ordnance Department U.S.A., January 1937.</i>
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Appendix A

FNOD Site Figure

FNOD Site Map



ID	Name
S-1	TNT Source Area
S-2	James River Beachfront
S-3	Impregnite Kit Area
S-4	Horseshoe Pond
S-5	Main Burning Ground & Steamout Pond
S-6	Track K Tire Pile & Paint Can Dump Area
A-1	Nansemond River Beachfront
A-2	Streeter Creek & Lakeview Drive Ground Scars
A-3	Near & Offshore Areas
A-4	GE Pond & Culvert
A-5	Tidewater Community College Lake
A-6	Marine Corps Power Generation Plant
A-7	J-Lake
A-8	Track A Magazine Line
A-9	Track A & B Burning Ground
A-10	Track G Magazine Line
A-11	Track H & I Magazine Line
A-12	Track J Magazine Line Scars
A-13	Former Wastewater Treatment Plant
A-14	Track K Magazine Line Scars
A-15	Track K Magazine Line Landfill
A-16	Removed Steam Heating Plant
A-18	Suspected Underground Storage Tank & Tunnel
A-19	TCE Contamination Adjacent To The James River Beachfront
A-20	Abandoned Water Treatment Plant
A-21	Officer s Pool Chlorine Containers
A-22	Arsenic Investigation
A-23	Renovation Plant Area
O-3	Athletic Field North
O-4	Athletic Field South
O-5	Building E-410
O-6	Building L-11 & L-12
O-7	Pesticide Drum Area
S: Source Area	
A: Area of Concern	
O: Other Area of Investigation	

Appendix B

Regulator Comments and USACE Responses